ELECTRICAL CONSTRUCTION AND MAINTENANCE

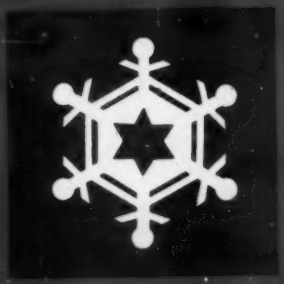
DECEMBER • 1955
PRICE 35 CENTS

WITH ELECTRICAL CONTRACTING

NECA hold convention, trade show in New York, Burnett named president.
Page 57

200-Amp expandable home service entrance makes debut in Spokane, Wash.
Page 62

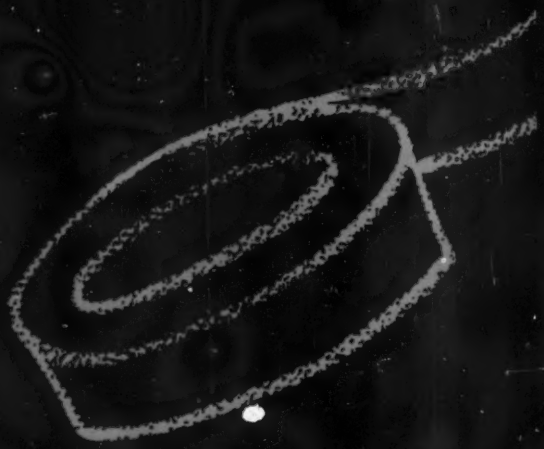
Modernization restores electrical life to 30 year old building.
Page 68



A McGRAW-HILL PUBLICATION 55TH YEAR

one plant...

one product...



the best...

Friction, Rubber Splicing
and Plastic Electrical Tapes *

ACCURATE

MANUFACTURING COMPANY
GARFIELD, NEW JERSEY

* OUR NEW CATALOG #47 WILL BE SENT ON REQUEST.

EDWARDS
PRE-SELLS THE MARKET—
YOUR MARKET!

Architects, engineers, school administrators ask: "are master clocks necessary?"

If clocks tend to coast, get out of step with each other, you need a constant source of correction. You need a master clock.

If you use the Edwards Synchromatic Clock System, you do *not* need to rely on a master clock. Here's why: Every clock in the Edwards system is on the same circuit, receiving its power directly from the ever accurate central station. There can't be any difference between clocks while operating. There's no need for a master clock with its hourly correction.

If power fails, the Telechron motor stops instantly—the light weight rotor can't coast. When power returns all clocks start simultaneously. And here's an important advantage... the Edwards Synchromatic control will automatically correct all clocks immediately—no matter how long the power was off. No waiting for the next hour—and sometimes several hours. You have *constant* accuracy with an Edwards Synchromatic System.

A flick of the switch on the central control is all that's necessary to adjust for changes in time.

These are only a few of the advantages available—for more information about Edwards Clock & Program Systems write Dept. MH-11.

Synchromatic Clock Systems

EDWARDS *Company, Inc.*
Norwalk, Conn.
In Canada, Owen Sound, Ont.

Edwards year-round advertising reaches schools, hospitals, architects and engineers.

Your school market alone is measured in more than millions—actually *billions!* Contracts awarded will reach an estimated $2 billion this year. Present building rate: 60,000 classrooms annually.

Today's construction contracts: tomorrow's jobs for you.

Not just in schools. Hospital market's on the rise too. First seven months of this year: $300 million, 50% jump in 2 years!

And remember—for every *new* school or hospital there are a hundred existing ones that need modernization.

What is Edwards doing to help you.

1—Edwards offers top products for schools and hospitals*. Products that are engineered with the contractor in mind... for ease of installation and a minimum of servicing.

2—Consistently places powerful advertising in school, hospital and architectural publications.

3—Backs you up with the finest technical assistance in the business.

The markets are there. The products are there. With Edwards you are assured of profitable participation.

***EDWARDS EQUIPMENT FOR SCHOOLS, HOSPITALS, INSTITUTIONS**

- **Synchromatic Clock and Program Systems**
- **Fire Alarm Systems**
- **Nurses Call Systems**
- **Paging and Call Systems**

EDWARDS *Company, Inc.*
Norwalk, Conn.
In Canada: Owen Sound, Ont.

APPLETON

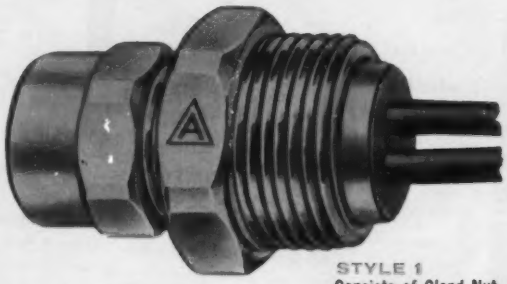
Entirely New!

"MI" Series Connectors* for simplified installation of Safety Mineral Insulated Cable

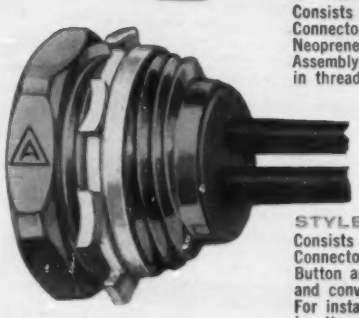
Fewest Components . . . No Messy Compounds!
No Maintenance . . . No Wire Pulling!

● You can speed up the job and *save money* on Mineral Insulated cable installations by specifying these new APPLETON "M.I." Series Connectors*. Threaded Hub Style has *only three* brass components . . . Knockout Style has *only one!* Simplified design makes for easier installation . . . eliminates sealing compound *every time*. Precision milled and threaded solid brass fittings positively exclude moisture and water, oil, chemical and acid fumes, and dirt from the electrical system and assures positive grounding. In addition, the *extra* quality built into each APPLETON "M.I." Connector preserves the efficiency of Mineral Insulated Cable and assures you of absolute reliability of performance. Write for Bulletin TMI-455 today.

*PATENT PENDING

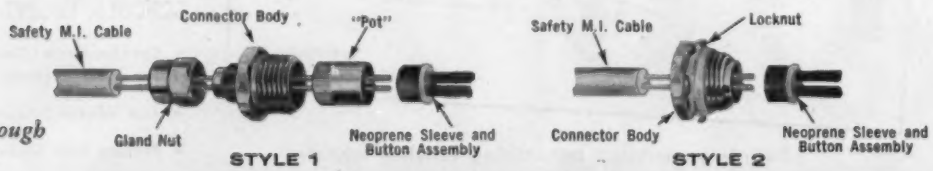


STYLE 1
Consists of Gland Nut, Connector Body, "Pot", and Neoprene Button and Sleeve Assembly. For installation in threaded conduit hubs.



STYLE 2
Consists of self-tapping Connector Body, Neoprene Button and Sleeve Assembly and conventional Locknut. For installation in steel junction box knockouts.

Simplified Design . . . Easy Assembly



Sold Exclusively Through Selected Wholesalers

APPLETON ELECTRIC COMPANY
1704 Wellington Avenue • Chicago 18, Illinois

Also Manufacturers of:

Rely on APPLETON *. . . The Standard for Better Wiring*

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electragist and Electrical Record — Established 1901

55th Year **DECEMBER • 1955**

Sidelights 5

Washington Report 7

Management Resources 55

NECA Convenes in New York 57
A report of the annual convention of the National Electrical Contractors Association.

200-Amp Expandable Residential Wiring 62
By AUGUST ECKEL—Industry sponsored and city enforced code rule breaks bottleneck to wiring adequacy and complete electrical living in Spokane.

Conducting Labor Cost Studies—II 65
By RAY ASHLEY—A discussion of break-down studies as the basis of accurate labor unit development and the establishment of true labor cost distribution.

New Life for a 30-Year-Old Office Building 68
Completed job reveals numerous practical installation methods developed by Herbst Electric Co.

Lighting a Country Club 72
By J. E. BURTON—Dramatic effect was primary objective in lighting this country club.

At the Test Bench—16 74
By WALTER J. PRISE—Checking ball bearings.

20 Key Questions on Electrical Maintenance—Part 1 76
A cross-country roundup of pertinent opinions obtained from industrial engineers, maintenance supervisors, contractors and motor shop operators located in 14 key cities of 9 states.

MORE

DECEMBER • 1955 *continued*

Power and Control for a Dredging Giant 79

By M. A. NESLIN—Primary power at 13.8 kv is obtained through submarine cables extending from shore-based trailer-mounted 10,000-kva substation.

Practical Methods 91

Split-grouping balances stadium lighting; contractor uses mobile shop; mobile conduit bender has gas-driven power unit.

Motor Shops 103

Peg board keeps bench tools in order; separate room for insulation storage; vacuum clears dust from sanding disc.

Reader Service 113

Product news announcements, catalogs and bulletins.

Reader's Quiz 141

Questions and answers on dc filaments in vacuum tubes; using heat to shrink-on bearings; class 3 poles for overhead lines.

Questions on the Code 146

Answers to code questions including wiring a farm house; small diameter wires; insulation; E. M. T. in hazardous location.

In the News 157

Dates Ahead 167

Annual Index 173

W. T. STUART, *Editor*

Alice McMullen, *Associate Editor*

Berlon C. Cooper, *Eastern Editor*

August Eckel, *Middle West Editor*

Hugh P. Scott, *Industrial Editor*

J. F. McPartland, Jr., *Assistant Editor*

W. J. Novak, *Assistant Editor*

John P. Reynolds, *Assistant Editor*

L. E. Devendorf, *Art Editor*

Ray Ashley, B. A. McDonald, Walter J. Prise, Glenn Rowell, B. Z. Segall, *Consulting Editors*

W. A. Cyr, *Western Consultant*

Dexter Keezer, *Dir. Economic Staff*

George B. Bryant, Jr., *Chief Correspondent, Washington Bureau*

John Wilhelm, *Editor, World News*

W. W. GAREY, *Publisher*

C. B. Shaw, *Advertising Sales Manager*

District Managers

A. B. Conklin, *New York*

S. A. Jones, *New York*

E. P. Gardner, *Philadelphia*

F. J. Seiler, *Cleveland*

R. A. Hubley, *Detroit*

Charles F. Minor, Jr., *Chicago*

R. R. Ream, *Chicago*

T. H. Carmody, *San Francisco*

C. W. Dysinger, *Los Angeles*

J. H. Cash, *Dallas*

W. D. Lanier, *Atlanta*

Member of
AUDIT BUREAU OF CIRCULATIONS and ASSOCIATED BUSINESS PUBLICATIONS

Vol. 54, No. 12 ELECTRICAL CONSTRUCTION and MAINTENANCE December 1955

Published monthly with an additional issue in September by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder. Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President, Joseph A. Gerardi, Vice-President, and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to Electrical Construction and Maintenance—Subscription Service, 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are solicited only from persons engaged in electrical construction or electrical maintenance. Position and company connection must be indicated on subscription orders.

Single copies 35¢. Electrical Products Guide $2.50 to those in the electrical construction and maintenance industry. Subscription rates—United States and possessions, $3.00 a year; $4.00 for two years. Canada, $5.00 a year; $8.00 for two years. Other Western Hemisphere and Philippines, $10.00 for one year; $16.00 for two years. All other countries, $15.00 a year. Three-year rates, accepted on renewals only, are double the one-year rate. Entered as second class matter August 29, 1938 at the Post Office at Albany, N. Y., under act of Mar. 3, 1879. Printed in U. S. A.

Copyright 1955 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved.

Sidelights

THOUGHT PROVOKING QUOTES–"Nuclear electric generating installations will become an appreciable factor within 15 years and, when this era opens, the world will be surprised at the speed of its development."–Lieut. Gen. Leslie R. Groves, Sperry Rand.

"The advent of automation will increase the electrical contractor's importance . . . will require more and better trained electricians; more engineers, service and repair crews."–Don B. Clayton, Sr., NECA.

"The American consumer, for the first time in a generation, is entering a period of good times with no immediate threat of either depression or wars . . . and if, right now, we set our sights toward the accomplishment of the three big jobs–the big (appliance) sales job–the adequate wiring job–the development of atomic power, we can take the economic tide that is running for us and ride it into a bright electrical future."–G. A. Price, Westinghouse.

"You have heard a number of predictions about future electric power consumption. Any prediction today cannot help but be on the conservative side. Optimistic as we may be, our predictions today cannot help but be based to a great extent upon our experience, upon what has happened before, and that simply doesn't cut any ice for the future. We might as well throw the book out the window because the future will write one new book after another."–Don G. Mitchell, Sylvania.

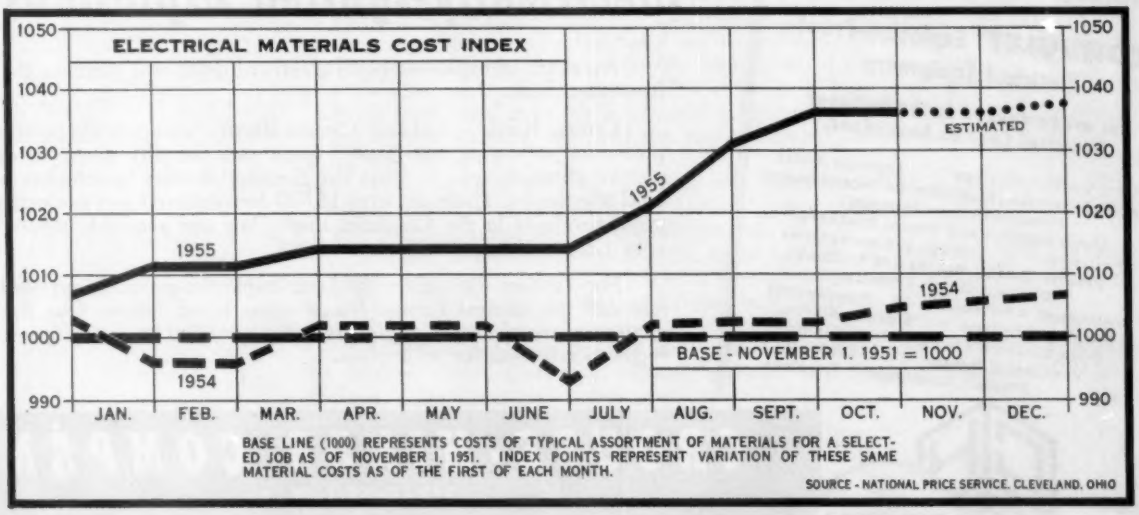
"American manufacturing industry is now planning to spend 30% more for new plants and equipment in 1956 than it is spending in 1955. . . . It's going to take some calculating . . . to determine whether American industry can actually command the physical facilities, in terms of labor and materials, to add as much to its plant and equipment as it now plans to add."–D. M. Keezer, McGraw-Hill.

ANNUAL INDEX–In recent years the volume of articles and reports published in *Electrical Construction and Maintenance* has grown substantially. The effect has been an increasing number of requests from our readers for a comprehensive index to provide convenient reference by subject, title and author to the contents of past issues. An index project was initiated this year and our first annual index for 1955 is included in this issue beginning on page 173. The index will be a regular service appearing in the December issue each year. The new service is part of our persistent efforts to continually improve the usefulness and value of *Electrical Construction and Maintenance*.

EXPANDABLE SERVICE–A new industry-sponsored service raceway rule in Spokane, Wash., requires a 200-amp meter socket and a 1¼-in. minimum service conduit. In this area residential service entrances are run concealed in the wall with a flush meter socket. Recognizing the very rapid growth in residential electrical loads, electrical and building industry groups sponsored the new city code rule to provide ample raceway capacity for any probable utilization. Mid-West Editor, August Eckel describes the new development in "200-Amp Expandable Residential Wiring" beginning on page 62.

CLUB LIGHTING–A round $100,000 worth of lighting equipment in a club is big news anywhere, even in Ft. Worth, Texas where Burton Bros. Electric Co. made such an installation at Ridgelea Country Club. Jack Burton's story "Lighting A Country Club," page 72, is not only important because it describes a spectacularly big job but because of the variety of special lighting effects applied. They will suggest many lighting opportunities for less luxurious surroundings.

MODERNZATION–Herbst Electric Company of Cleveland, Ohio, have recently completed the modernization of a 30-year old office building which typifies many electrical modernization projects. The job involved conversion from dc to ac and a boost in capacity from 2 to 10 watts per square foot. The story "New Life for a 30-Year-Old Office Building," page 68, describes numerous practical installation methods developed by the electrical contractor.



BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

Come to Crouse-Hinds

for Complete Protection against

Electrically-Ignited Explosions...

CONDULET® Explosion-Proof Electrical Equipment

for areas defined by the National Electrical Code as hazardous.

Rigid Conduit Fittings
Junction Boxes
Lighting Fixtures (Fluorescent & Incandescent)
Pendent Fixture Hangers
Motor Starters and Circuit Breakers
Switches
Plugs and Receptacles
Process Control Boards and Systems
Communication Systems
Instrument Enclosures
Panelboards
Mercury Switches
Signals, Alarms
Push Button Stations
Pilot Lights
Ventilating Breathers and Drains
Seals
Flexible Couplings
Unions

A NATIONWIDE **DISTRIBUTION** exclusively through **ELECTRICAL DISTRIBUTORS**

No chain of explosion-proof electrical devices is stronger than its weakest link.

Crouse-Hinds — and only Crouse-Hinds — can provide positive protection *wherever* the merest spark can possibly occur in explosive atmospheres . . . from size 5 motor starters to sound-powered telephones. There are over 15,000 conventional and explosion-proof products in the Condulet line! They are available through your Crouse-Hinds distributor.

For further assistance on your explosion-proofing problem, just call the nearest Crouse-Hinds office listed below. Our field engineers are *electrical* engineers, fully qualified to make specific recommendations for your plant.

CROUSE-HINDS COMPANY

SYRACUSE 1, N. Y.

OFFICES: Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Indianapolis, Jacksonville, Kansas City, Los Angeles, Memphis, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., St. Louis, San Francisco, Seattle, Tulsa, Washington. REGIONAL REPRESENTATIVES: Albany, Atlanta, Baltimore, Baton Rouge, Charlotte, Cincinnati, Columbus, Dayton, Des Moines, Hartford, Kansas City, Mo., Milwaukee, Newark, Norfolk, Oklahoma City, Omaha, Peoria, Providence, Richmond, Va., Rochester, Salt Lake City, Toledo, Utica, Wichita. CANADIAN DISTRIBUTORS: Crouse-Hinds of Canada Ltd., Toronto, Ont.

CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING

Washington Report

The business boom keeps rolling as one economic barometer after another registers a new high. Latest reports show:

- Gross National Product soared to $391.5 billion annual rate during 3rd quarter, up $6.5 billion over 2nd quarter's previous high of $384.8 billion (seasonally adjusted), and up $41.5 billion (14.5%) over the year-earlier rate of $350 billion.
- Employment at mid-October hit a new high for the month of 65.2 million (but down 300,000 from the all-time record of 65.5 million in August), while unemployment stood at 2.1 million, or 600,000 lower than a year earlier.
- Industrial production rose to another record in October, to 146% of the 1947-49 average, a hefty 16 points above October of last year.
- Total retail sales are estimated at about $171 billion by the end of November, equal to total sales for entire year in both 1953 and 1954. Thus December sales will be in excess of previous record sales.

Danger signals in the national economy include:

- Personal debt rose to $34.3 billion at the end of September for installment and non-installment credit, up $5.5 billion in 12 months.
- Building materials costs hit a peak of 128.4% of the 1947-49 average in September, up 8.4% over mid-1954, and up 26% in six years. This compares with 12% price increase average for all commodities.
- Cost-of-Living Index in September rose to 114.9% of the 1947-49 average, only .5% below the record high of 115.4% in October 1953.

U. S. power needs in 1980 are estimated at 1.9 trillion kwh by the Federal Power Commission, or some four times 1954's annual consumption rate of 478 billion kwh.

Electric power output continues to climb at an accelerating pace, has surged more than 15% ahead of 1954, due to increased business activity keeping industrial plants running full time and overtime, addition of over a million new homes, and an increase in power use for air conditioning, electric space heating, and a wide variety of home electric appliances. Output in mid-November was running about 18% above like 1954 period, at 10.878 billion kwh weekly. Maximum increase was in the Central Industrial region, at 30.3%; second place was in the Southeast region, at 20.2%.

New construction spending next year will total $44 billion, a new record, according to recent joint estimate of Commerce and Labor Depts., or some 5% increase over the $42 billion peak indicated for 1955. Principal gains, it is estimated, will be in private nonresidential and public construction . Here are some of the highlights of the forecast:

- Private residential construction will be in excess of $16 billion, near 1955 level, and over 35% of total construction expenditures. New housing dollar volume will reflect trend toward larger homes, with more quality features.
- Nonresidential private building will total about $8.7 billion, up 14% from 1955, with largest gains (17% above 1955) in industrial building and for stores and service establishments.
- Record levels are predicted for construction of highways, schools, and sewer and water facilities, for which requirements are especially pressing.
- Expenditures for military facilities will continue to rise.

Remodeling and repairs by home owners next year will total a record $8 billion, FHA forecasts. These outlays will help offset new housing decline, Commerce and Labor predicts.

Simplex Cables power and control longest, single-span vertical-lift bridge in the world!

Cape side of canal with bridge span down. Seven of nine cables visible are Simplex-ANHYDREX. Light-colored square beneath catwalk is 1100-ton concrete counterweight that rides inside the framework of each tower.

U. S. Army's 544-foot railroad span over Cape Cod Canal raised 130 feet with ANHYDREX

The 2200-ton span, located near Buzzards Bay in Massachusetts, carries the only railroad track between Cape Cod and the mainland.

Army and Air Force installations on the Cape depend upon this track for supplies. Therefore, both normal and emergency electrical circuits on the bridge must be as near perfect as possible.

The railroad company that maintains the bridge specified Anhydrex-insulated cables with neoprene jackets. Army engineers, who own and operate the bridge, approved this choice.

ANHYDREX Cables withstand effects of moisture, corrosion from salt air, sunlight and swaying in high winds.

Want the same service from power and control cables as the Army engineers? Ask your nearest Simplex representative about ANHYDREX Cables, or write to the address below.

Closeup of ANHYDREX Cables. Mainland on left. Span is raised and lowered by two 150-horsepower electric motors that turn 16-foot sheave wheels atop the bridge's two towers.

Simplex-ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Massachusetts

The National Merit Scholarship Corporation

Business is Offered Big Dividends on Investment in Higher Education

The McGraw-Hill Publishing Company is availing itself of the opportunity to establish ten National Merit Scholarships. They will be known as the McGraw-Hill Merit Scholarships. The scholarships are to be awarded to qualified candidates for a four-year college course in the fields of science, engineering and the other professions and the liberal arts. There will be no limitation, beyond the appropriate professional accrediting, on the college or university selected by a successful candidate. As part of a continuing program to aid higher education and educational institutions, McGraw-Hill is happy to be able to share in what it believes to be the constructive educational endeavor of the National Merit Scholarship Corporation.

Business firms searching for a satisfactory avenue to provide financial aid for our colleges and universities now have a new opportunity of major importance. It is provided by the National Merit Scholarship Corporation, which has offered to devote $8 million to matching, dollar for dollar, gifts by business firms for college scholarships and supplemental gifts to the institutions where the scholarships are used.

The National Merit Scholarship Corporation, an independent agency financed initially by gifts of $20 million from the Ford Foundation and $500,000 from the Carnegie Corporation, has three major purposes which are closely related. They are:

1. To locate those of the nation's young men and young women who are best equipped to go to college.

2. When necessary, to help these young people go to college by giving them financial aid.

3. To help colleges and universities meet the full cost of the instruction of those to whom National Merit scholarships are granted.

At present about half of the nation's top high school graduates do not go to college. The principal reason is that they do not have the money required.

To Save Unused Brain Power

The National Merit Scholarship Corporation will strive to eliminate this dangerous neglect of top-flight ability. To this end it is inviting the nation's high schools, numbering more than 24,000, to participate in its program by designating as available candidates for National Merit scholarships the top 5 percent of their senior classes. Those so designated are then invited to take a series of tests and to submit reports designed to assure selection of the very best talent in each state. The number of scholarships to be allotted to each state will be proportionate to the number of high school graduates in the state.

The winners, the total number of whom will be determined by the amount of money the Scholarship Corporation has available, will be eligible for awards. For those who need no financial help to go to college there will be honorary awards of $100. For those who must have help the Corporation will grant scholarships covering as much as necessary

of the cost of instruction and living expenses for a four-year college course.

Colleges Get Financial Help

The provision of funds to cover the students' expenses does not, however, solve the financial problems faced by many colleges. That is because the tuition charges paid by the students do not cover the cost of the instruction. The deficit must be met by drawing upon endowment funds, gifts, grants, and other available sources.

Consequently, to prevent holders of National Merit scholarships from imposing any additional financial burden on the colleges and universities they elect to attend, the Corporation will make a supplementary grant to these institutions. The supplementary grant will be the equivalent of regular tuition charges made by the school, with a top limit of $1,500 a year for both the tuition and the supplement.

As the scholarship grants to the winning students will vary, depending upon how much financial help they need, so will the supplementary grants vary from one college to another, depending on their regular tuition charges. However, it is anticipated that on the average the full cost of a National Merit scholarship—including aid to the student and the supplement to the college—will be about $1,500 a year.

Many business firms will find a compelling appeal in a program which is designed at once to mobilize the nation's intellectual resources more effectively and, in the process, give very badly needed financial help to our colleges and universities.

Two For One Return Offered

However, there are numerous other inducements to business firms to finance National Merit scholarships. These scholarships may:

1. Carry the name of the firm or be named in honor of someone designated by the firm.

2. Be limited to use in types of colleges of particular interest to the sponsoring firm.

3. Be limited to a college course, such as science, engineering or liberal arts, of special concern to the sponsor.

4. Be restricted to candidates or institutions in geographic areas specified by the sponsor.

In addition to these advantages there is a special financial inducement to help the Merit Scholarship program. It is that for every Merit scholarship a firm or individual finances, the Corporation will, up to the limit of $8 million, match the funds and make another National Merit scholarship available.

There are many good ways of helping our financially beleaguered colleges and universities, and many corporations are already using one or more of them.* For those companies that can do so without embarrassing complications one of the best ways is to make unrestricted gifts directly to the institutions. But this new way provided by the creation of the National Merit Scholarship Corporation (Address: 1580 Sherman Avenue, Evanston, Illinois) has the broad appeal of serving two purposes of transcendent importance simultaneously. The purposes are to see that our best brains are fully trained and utilized and that our colleges and universities, crucial contributors to this process, are helped at the same time. Business will serve the nation and its own community well by giving the National Merit Scholarship Corporation generous help.

---

* These, as well as the plight of our colleges and universities, are discussed in a pamphlet, "Business Aid to Our Colleges and Universities," which embodies a series of five editorials which appeared in all McGraw-Hill publications. Copies of the pamphlet can be obtained without charge by addressing the Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, New York.

Methods of helping our colleges and universities financially are also outlined and discussed in a pamphlet, "Aids to Corporate Support of Higher Education," which may be obtained without cost by addressing the Council for Financial Aid to Education, 6 East 45th Street, New York 17, New York.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

THIS BOOK EXPLAINS WHY
U. S. Laytex Royal Master
ELECTRICAL CORDS HAVE
3 TIMES LONGER LIFE

Send for your FREE copy today. The book contains complete and valuable data about the U. S. Laytex Royal Master Portable Cords. It summarizes the results of thousands of scientific tests conducted over the last three years, during which the U. S. Laytex Royal Master Portable Cord was developed and perfected. This book presents conclusive evidence that U. S. Laytex Royal Master Portable Cords will give you unmatched durability and efficiency.

Write to us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Electrical Wire and Cable Department

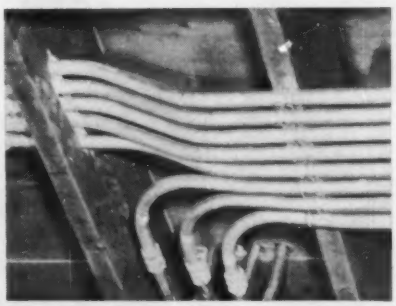
United States Rubber

From Start to Finish, Save with

Architect: Bernard Krauss, Chicago; Electrical Contractor: Summit Electric Co., Chicago; Distributor: Bright Electrical Supply Co., Chicago; Address: Mozart and Granville Avenues—total of 15 apartments.

When matched with reference marks on the bender, "Inch-Marks" and Guide-Line on Republic E.M.T. assure consistently accurate bends.

Neat, multiple-run installations are no problem with ELECTRUNITE Electrical Metallic Tubing. Planned runs can be followed with ease.



REPUBLIC STEEL CORPORATION
212 East 131st Street
Cleveland 8, Ohio

REPUBLIC STEEL

Please send me more information on:

☐ Republic "Inch-Marked" E.M.T.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Box connectors and couplings make tight connections. They require no thread cutting, no turning of entire runs.

"Inch-Marked" E.M.T.

Architect: Bernard Krauss, Chicago; Electrical Contractor: Maron Electric Co., Chicago; Distributor: Bright Electrical Supply Co., Chicago; Address: Seeley and Fargo Avenues—total of 22 apartments.

WHOSE E.M.T.? Republic's ELECTRUNITE®, of course, because Republic alone makes "Inch-Marked"® E.M.T.—used throughout these two new Chicago apartments.

WHY ELECTRUNITE? Because ELECTRUNITE goes in with maximum ease at minimum cost. Ease of installation is designed in through such exclusive features as "Inch-Marks", Guide-Line, Inside-Knurling . . . features you positively cannot get in any other raceway product, regardless of brand.

WHAT'S "INCH-MARKING"? "Inch-Marks" are printed along each length of ELECTRUNITE E.M.T., showing length in both feet and inches. You need only measure the run, not the raceway, and cut at the right "Inch-Mark". And, when "Inch-Marks" are matched with reference marks on the bender, accurate bends are easy.

WHAT'S "GUIDE-LINE"? The printed Guide-Line on ELECTRUNITE E.M.T. lines up with arrows on the new Republic bender to assure in-line bends every time . . . right on the job.

SO? So add the benefits of "Inch-Marks" and Guide-Line to Inside-Knurling for easier fishing and wire-pulling . . . to high ductility for smooth, easy bending . . . to connectors and couplings which eliminate thread cutting and turning of entire runs . . . and you come up with real savings.

Specify Republic "Inch-Marked" E.M.T. on your next job and you'll get the best run for your money. Meantime, mail the coupon for more information.

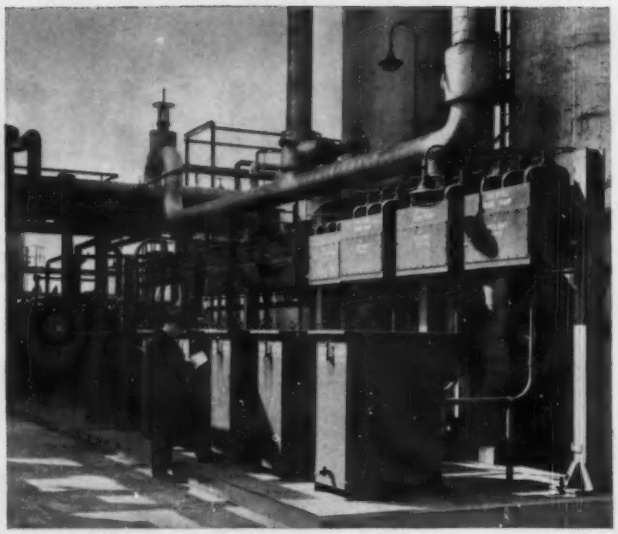
REPUBLIC STEEL

World's Widest Range

of Standard Steels and Steel Products

COMPLETE LINE of G-E oil-filled cutouts includes pole, pothead and subway types and metal-enclosed assemblies.

UTILITIES with underground systems use G-E oil-filled subway-type cutouts for single phase or three phase, gang-operated, fusing or switching. Expansion chambers are required to secure full interrupting rating.



INDUSTRIALS, such as this oil refinery, use these three-phase metal-enclosed G-E oil-filled cutout assemblies to protect equipment.

For best in low-cost switching...industrials, electric utilities choose G-E oil-filled cutouts

Indoors or outdoors, they permit substantial savings on first cost and fuse replacement—combine high interrupting capacity, safer operation and long life

For utility, industrial, commercial and institutional applications that combine overcurrent protection and load-break switching, more and more companies are choosing General Electric oil filled cutouts.

HERE'S WHY: Low-cost G-E oil-filled cutouts provide high interrupting capacity . . . up to 11,000 rms amperes. They provide for maximum safety of personnel . . . all arcing occurs under oil and all flame, noise and electrically live parts are confined within a metal housing. And G-E oil-filled cutouts offer long service life since interrupting ratings are based on test conditions far more severe than those normally encountered in operation.

IDEAL INDOORS OR OUTDOORS G-E oil-filled cutouts are quiet in operation, and they may be wall or direct-to-equipment mounted. Single- or three-phase metal-enclosed assemblies provide for all wiring and electrical connections to be completely enclosed in a grounded steel cabinet. Entrances can be provided for connection to outgoing cables.

Other G-E oil-filled cutout features include:

- Simple fusing, even on gang-operated assemblies. Preformed fuse links easily slip into place.
- Silver-plated self-aligning contacts of heavy forged copper with special arcing tips . . . minimize wear.
- Leads brought into cutout housing above oil level—no gasketed joints under oil pressure.
- Pole and pothead types do not require expansion chamber for full interrupting capacity.

If you have an application that requires overcurrent protection *plus* load-break switching, it will pay you to investigate G-E oil-filled cutouts. Available for 2400-, 4330- and 7200-volt circuits, they can mean substantial savings in initial costs and fuse replacements.

For complete information, contact your nearest G-E Apparatus Sales Representative, or write for bulletin GEC-863, General Electric Company, Schenectady 5, N. Y. 433-12

Progress Is Our Most Important Product

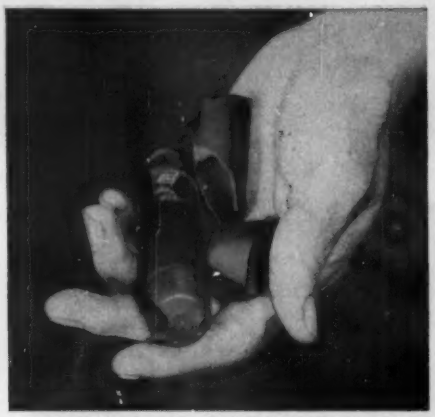
GENERAL ELECTRIC

TEST SETUP. Conventional fuses and G-E Type CLF fuses are mounted in standard fuse boxes for short-circuit test of 40,000 amps at 575 volts A.C.

CLOSE-UP OF CONVENTIONAL FUSE shows that failure to interrupt has touched off explosion. Picture was taken at instant the test power was applied.

FORCE OF EXPLOSION in normal operation could seriously injure operator and necessitate fuse box replacement.

CONVENTIONAL FUSE IS BLOWN completely out of fuse box (see arrow lower right). In another test, closed fuse box door blew open violently.



FRAGMENTS OF CONVENTIONAL FUSE, picked up from various parts of the room, show force of explosion possible in any plant with inadequate fuses.

CLF FUSE shows no external damage. Other tests ranged from slight overload up to rating of 100,000 amps.

HI-SPEED MOVIES OF DRAMATIC TEST PROVE . . .

G-E Type CLF Fuses Protect Your Circuits When Conventional Fuses Can't

You can't afford to take chances when it costs so little to have adequate fusing—and when the results of inadequate protection can be so costly. The growth of your electrical system and the expansion of the utility power systems has made possible short circuits that conventional fuses may no longer interrupt.

The General Electric Type CLF fuse is specially designed for such applications on low-voltage circuits (600 volts and below). The interrupting ability of the CLF fuse is 100,000 amperes a-c or d-c. The fuse interrupts so fast that the current does not reach its normal peak value—a current-limiting ability that provides better protection to equipment on the line.

The silver-plated CLF fuse will fit any standard NEC fuse holder of the same voltage and current rating. However, special fuse clips are available which will accept only the CLF fuse. Their use is recommended to prevent substitution of conventional fuses having inadequate interrupting capacity.

Fuses are available from your local G-E Apparatus Distributor. For more information, send coupon below. General Electric Company, Schenectady 5, New York.

TYPE CLF FUSE CARRIES LABEL OF UNDERWRITERS' LABORATORIES

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Company
Section C522-3
Schenectady 5, New York

Please send me bulletin GEA-6319, Type CLF Fuse.

NAME.....

COMPANY.....

STREET.....

CITY..... **STATE**.....

3 CUSTOMERS STATE . . .

Space, Safety

Placed on the market in July of this year, General Electric's all-new Limitamp Control has received enthusiastic acceptance throughout industry.

1. NEW MOUNTING ARRANGEMENTS. Almost immediately, L. L. Hamig, of Ferris & Hamig, Consulting Engineers, found the exclusive front-connected feature of the new control solved a tough application problem. There is no need for a back aisle with the new equipment, so units may be mounted back-to-back, back-to-wall, or as free standing enclosures yielding great space savings.

2. 50% SMALLER. In another case, H. A. Weigand, of Ingersoll Rand Company specified this new fused starter in a compressor station for the Laclede Gas Company of St. Louis, Missouri. Mr. Weigand stated the new control's 50% floor space saving feature simpli-

50% smaller than previous models, all-new G-E Limitamp Control offers a gang-operated disconnect switch as standard equipment. See opposite page for space savings comparisons.

"The all front-connected feature of G.E.'s Limitamp Control gave me the versatile floor arrangement I needed to solve a tough application problem," said Mr. L. L. Hamig (extreme left) of Ferris & Hamig, Consulting Engineers, St. Louis, Mo. Seated are R. E. Watts of Ferris & Hamig and P. L. Korklan, General Electric Co. Sales Engineer.

"The space savings offered by G.E.'s Limitamp Control helped simplify the installation of a compresser station for the Laclede Gas Co. of St. Louis," according to H. A. Weigand of Ingersoll Rand Company. The compresser station is located in a residential area and conforms to local building codes. This put space requirements at a premium and posed a real installation problem.

Problems Solved by New G-E Limitamp* Control

fied installation where space considerations were a primary factor.

3. ADDED SAFETY. One of the nation's largest automobile manufacturers ordered eight of the starters and within days increased the order to 17. The gang-operated disconnect switch and co-ordination features which afford greater protection of the starter, the controlled equipment, and personnel were exactly what they wanted.

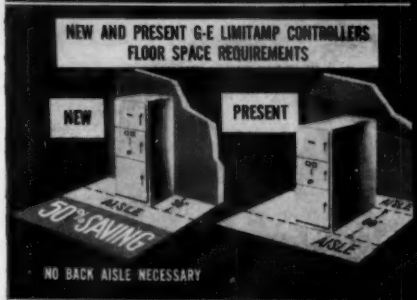
The 30" depth of the new Limitamp Control, which allows the unit to be transported through normal size doorways, has also received industry-wide approval. The unit's 90" height includes bus compartment which is surrounded by steel barriers within the enclosure.

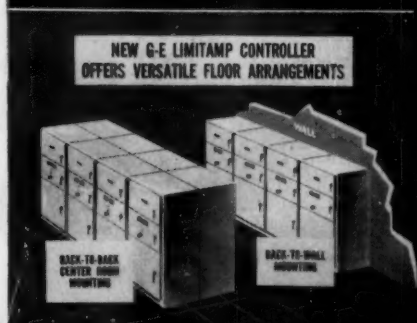
Other features which save time and money on installation and maintenance are the low-voltage panel, hinged to swing out of the cabinet, and the contactor which may be easily rolled in or out of the enclosure. This provides ample room for a worker to enter the enclosure while making installation connections.

This all-new Limitamp Control is ideal for high-voltage motors, rated 2300-4800 volts, up to 3000 hp, and may be applied to squirrel-cage, synchronous, wound-rotor, and multi-speed motors on power systems requiring high interrupting capacity for maximum short-circuit protection.

Specify the all-new Limitamp Control through your nearest G-E Apparatus Sales Office. G-E engineers will help apply this new control to your operation. For more information write for Bulletins GEA-6331, GED-2446, to Section 781-14, General Electric Company, Schenectady 5, New York.

*Trade-mark of General Electric Co.



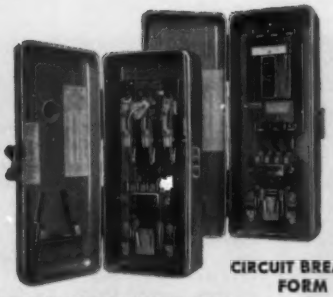


Progress Is Our Most Important Product

GENERAL ELECTRIC

WHY G-E COMBINATION STARTERS ARE...

Better for you

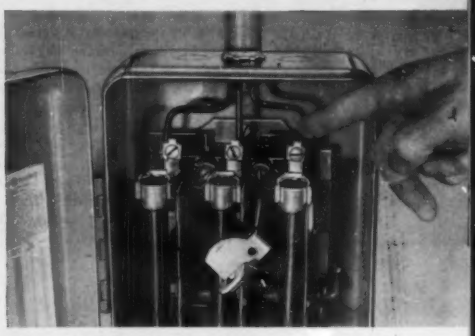


CIRCUIT BREAKER FORM

NON-FUSIBLE AND FUSIBLE DISCONNECT SWITCH FORMS

QUICKER MOUNTING—combination starters save you money because the starter and safety switch are in one enclosure. Single unit is supported by a keyhole slot while mounting screws are inserted and tightened.

REDUCED WIRING TIME—starter and disconnect switch are prewired at the factory to cut your costs. The time you would spend making interconnections between the starter and disconnect switch is saved.

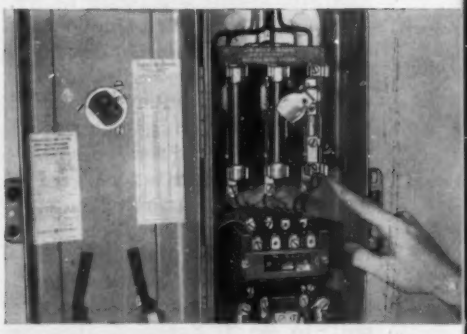


EASIER CONNECTIONS—plenty of space for wiring speeds installation. All wiring to switch and starter is front connected and twelve combination knockouts in the top, bottom, sides and back simplify wiring.

Better for your customer

GREATER SAFETY—mechanically interlocked door protects personnel. Door can't open when power is "ON", and the switch position is clearly indicated. Operating handle and enclosure door can both be padlocked.

SMALLER MOUNTING AREA—combination starter saves more machine space than a separate starter and safety switch. Also, better appearance results from the modern design of combination starter enclosure.



GREATER FLEXIBILITY—interchangeable fuse clips for the disconnect switch reduce your stocking costs. Clips can be added to non-fusible forms, or changed in size on fusible forms. Fuse clips are available in kit form.

Every time you plan to install a separate starter and safety switch, you will save time and money—and benefit your customer—if you use a General Electric combination starter. Combination starters are available with a non-fusible or fusible disconnect switch, or a circuit breaker. They include all the proved features of G-E magnetic starters such as strongbox coil, permanent air gap, bi-metallic overload relays, and all the speedy installation features that reduce your costs.

The next time you need a starter with a disconnecting means, or short-circuit protection, choose a combination starter from General Electric's complete line of quality control. *General Purpose Control Department, Bloomington, Illinois.* 733-3

For further information, contact your G-E Apparatus Distributor.

GENERAL ELECTRIC

G-E INDIVIDUAL BREAKERS also feature easy installation, plus lower cost. Installation of high-quality equipment results in greater customer satisfaction, higher reputation and more profitable business.

FASTER INSTALLATION of General Electric switchgear is made possible because of pre-assembly and pre-testing at factory. No bus for you to install; no "bugs" to iron out.

CONTRACTORS!

YOU CAN SAVE MONEY WITH G-E SWITCHGEAR

When your plans call for load-center unit substations, drawout switchgear equipment or individually mounted circuit breakers, it will pay you to check G.E. first. Competitively priced, General Electric low-voltage switchgear has extra quality features that can offer considerable savings in installation, connection, and maintenance. You'll find that these G-E features will pay off in dollars and cents:

NEW LOW COST—General Electric has increased the interrupting ratings of Type AK air circuit breakers by as much as 50%. This means you can use smaller, and consequently less expensive, breakers all down the line . . . save up to 33%.

FASTER, EASIER INSTALLATION—Shipped to you factory assembled and pre-tested, G-E switchgear arrives ready to connect into the system. You save by cutting expensive man-hours to a minimum.

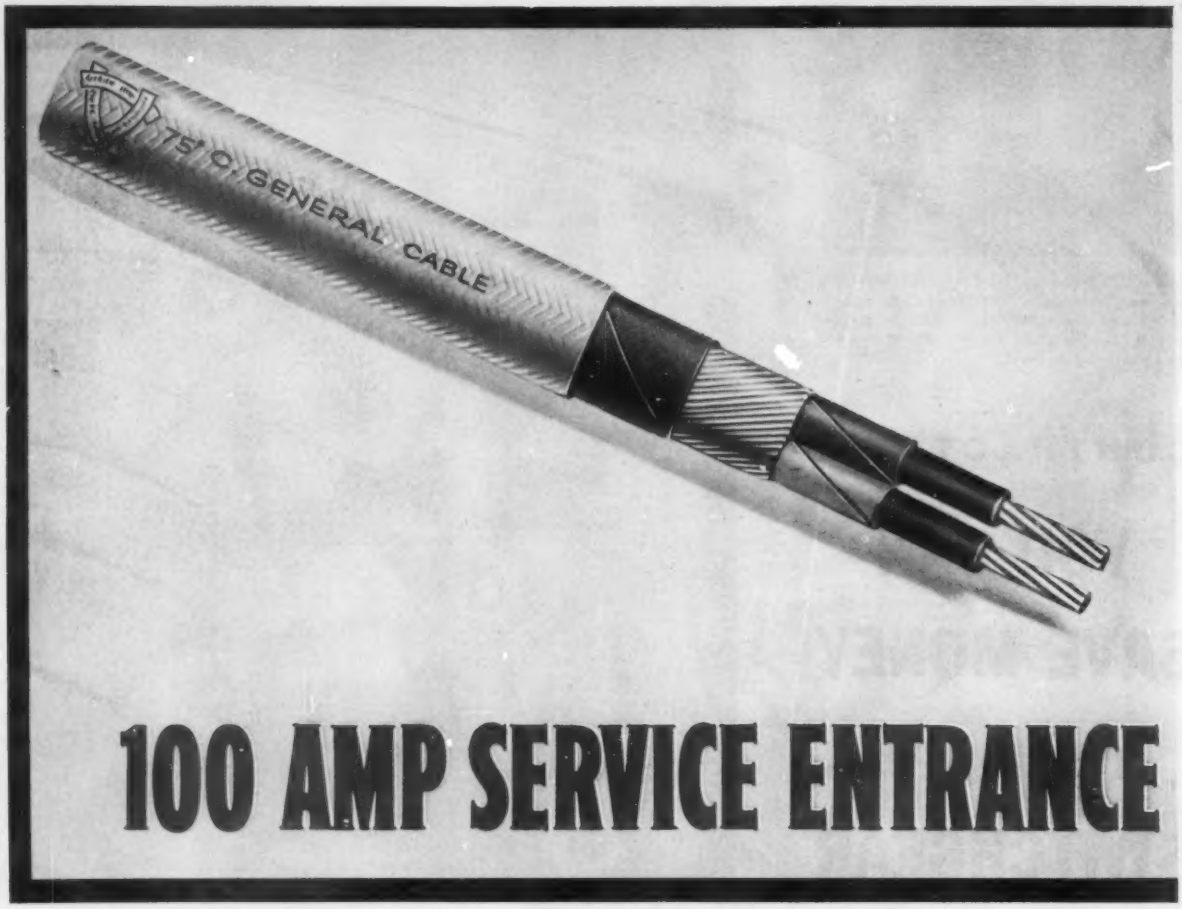
YEARS OF USER SATISFACTION—When you convince your customers to specify equipment of G-E quality you not only run less risk of losing profits through installation difficulties and expensive call-backs—you also build a reputation for high-quality work that will bring in more business.

FOR MORE INFORMATION, see your G-E Apparatus representative, or write for bulletins GEA-3592, Load-center Unit Substations; GEA-5916, Drawout Switchgear; GEA-5915, Air Circuit Breakers. General Electric Company, Schenectady 5, New York. 523-4

Progress Is Our Most Important Product

GENERAL ELECTRIC

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

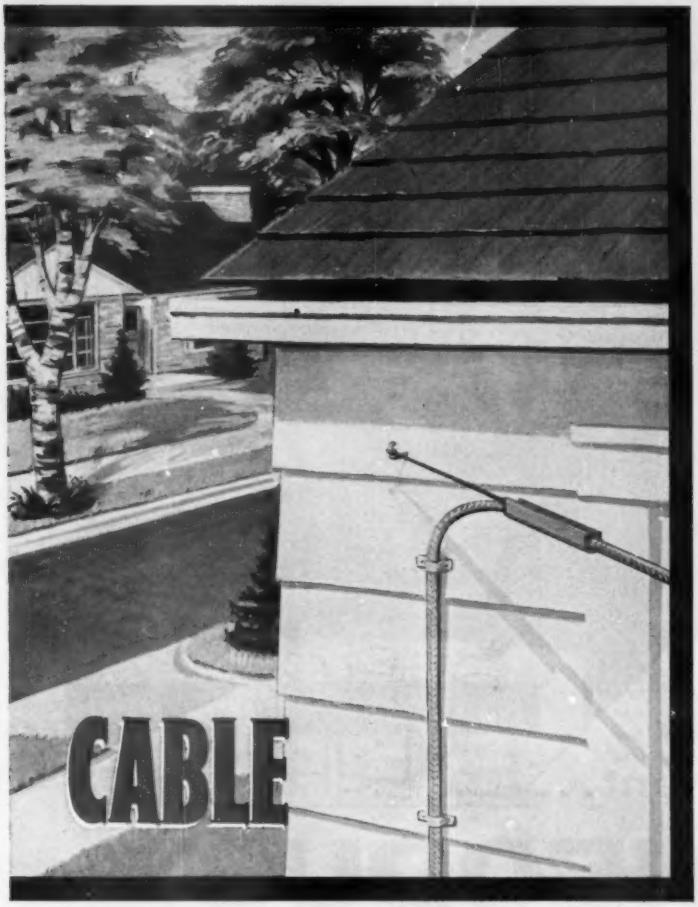


100 AMP SERVICE ENTRANCE

General Cable's Service Entrance Cable with new aluminum lacquer finish will not flake, peel, festoon, fray, bleed through, become sticky, or mark walls. Clean inside and out—it's easy to install, requires no conduit. Underwriters' Laboratory Approved.

GENERAL CABLE
CORPORATION

introduces a new, improved, economical <u>TYPE SE</u>



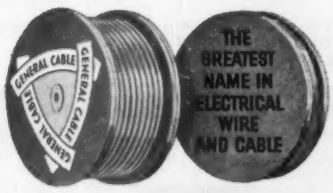
+ 75° c. RATING
wet or dry

+ LOWER COST
because new design permits use of #3 wire instead of #2

+ CHOICE OF SIZES
for 100-amp service permits you to take advantage of differences in local codes: either 3 conductors of #3 wire, or 2 of #3 wire and 1 of #5

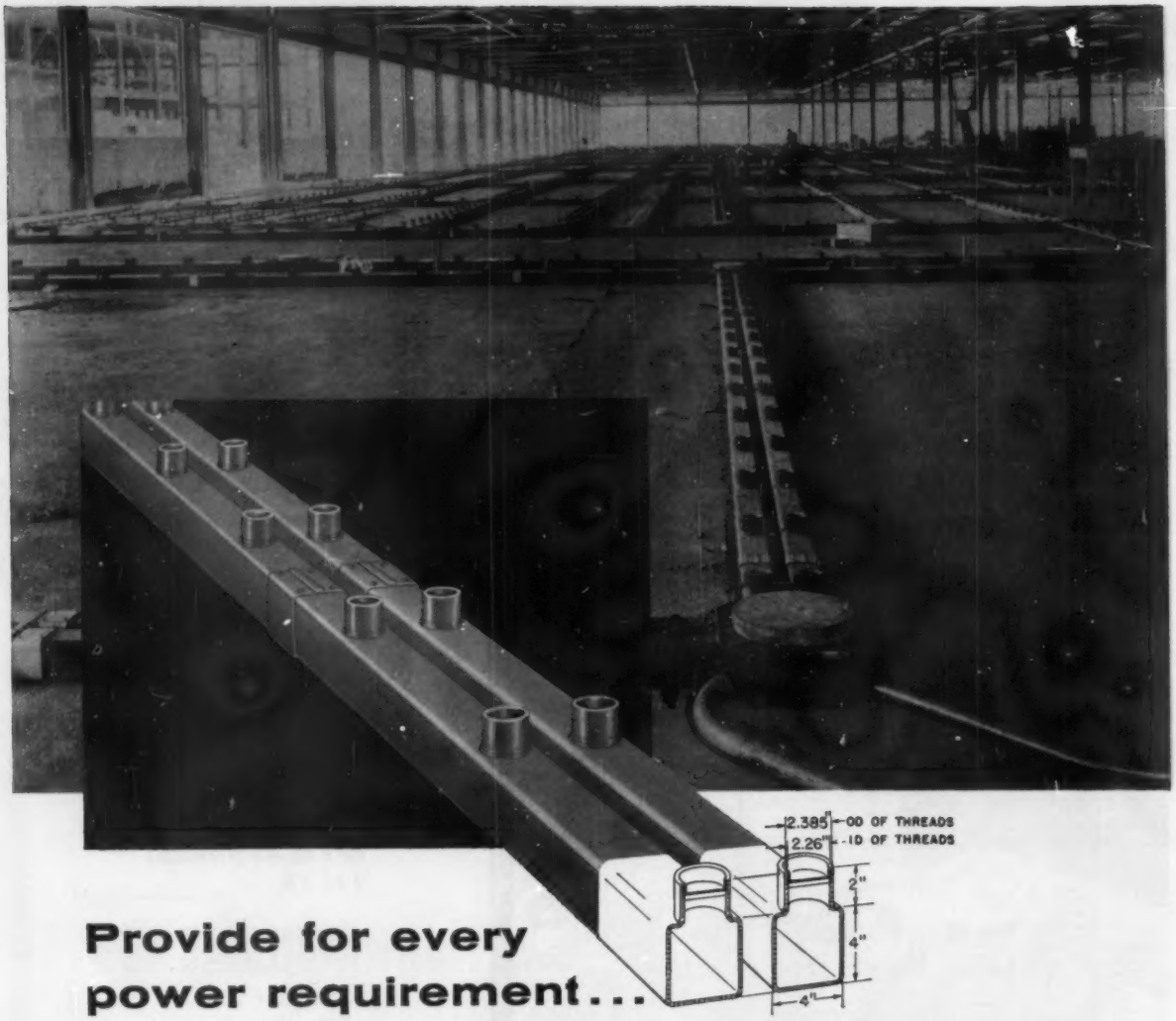
+ AVAILABLE NOW
from your local Authorized General Cable Distributor

Complying with NAHB Voluntary Adequate Wiring Code — this new, improved cable is ideally suited to meet the heavier loads resulting from the rapid acceptance of high-current appliances.



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION
Executive Offices: 420 Lexington Ave., New York 17, N. Y.
Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Erie (Penn.), Greensboro (N. C.), Houston, Indianapolis, Kansas City, Lincoln (Neb.), Los Angeles, Memphis, Milwaukee, Minneapolis, Newark, New Haven, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Richmond (Va.), Rochester, Rome (N. Y.), St. Louis, San Francisco, Seattle, Springfield (Ill.), Syracuse, Tampa, Tulsa, Washington (D.C.).



Provide for every power requirement...

specify JUMBODUCT

INDUSTRIAL UNDERFLOOR ELECTRICAL RACEWAYS

Versatile in design, National Electric Jumboduct offers plenty of capacity for production line wiring . . . eliminates the hazard of overhead wiring . . . permits flexible, attractive plant layouts by providing for readily accessible electrical distribution in the floor at a minimum cost.

A Jumboduct system in your plant means:

Plenty of capacity

4" x 4" Cross Section—more room for wires

Efficient power distribution

2" pipe threaded outlets every 24" permits exact location of equipment

Low Cost

- Easy-to-handle 10′ lengths
- Same simple installation procedure as standard Nepcoduct
- Quick access to inserts
- Investment in conductors limited to today's needs with ample space for tomorrow's additions

Safety

- Protected against corrosion by Sherardizing
- Coated with a baked-on acid-resisting enamel
- A completely grounded all-steel system

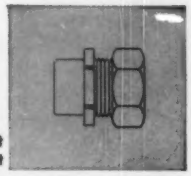
Get the details on JUMBODUCT today! Write for your free copy of the engineering Data Book on NE JUMBODUCT.

National Electric Products

PITTSBURGH, PA.

3 Plants • 10 Warehouses • 36 Sales Offices

50TH ANNIVERSARY



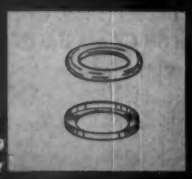
For Liquid-Tight to Rigid Conduit

ONLY Efcor LIQUID-TITES HAVE ALL 3!

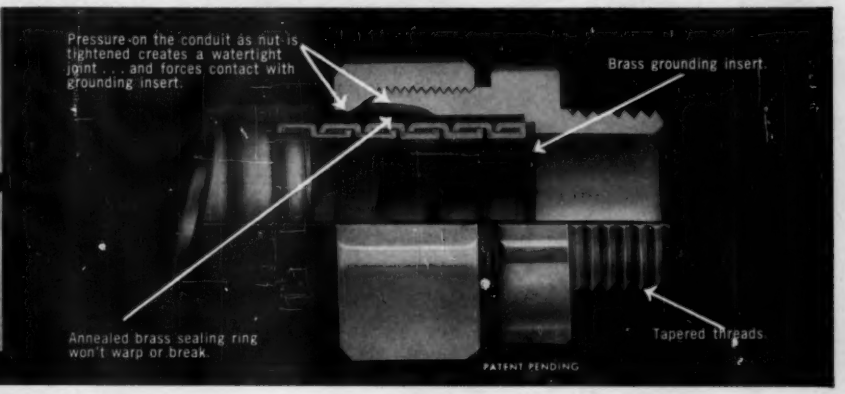
45° Liquid-Tite

- **TIGHTEST SEAL** *(with preassembled brass ferrule)*
- **POSITIVE GROUND** *(you can feel it "click")*
- **INSTALLATION WITHOUT DISASSEMBLY**

90° Liquid-Tite



Gasket Sealing Assembly


Pressure on the conduit as nut is tightened creates a watertight joint . . . and forces contact with grounding insert.
Brass grounding insert.
Annealed brass sealing ring won't warp or break.
Tapered threads.
PATENT PENDING

COMPARATIVE ANALYSIS PROVES EFCOR BEST!			
product	completely liquid-tight	positive ground	installation without disassembly
Efcor LIQUID-TITES	YES	YES	YES
CONNECTOR A	NO	NO	YES
CONNECTOR B	NO	NO	YES
CONNECTOR C	NO	YES	YES
CONNECTOR D	YES	YES	NO

Only Efcor LIQUID-TITES provide... tight moisture-proof seal, positive ground *always*, connection without disassembly . . . three features you need for more dependable and easier connection of liquid-tight flexible conduit.

INSTALLATION WITHOUT DISASSEMBLY — There are no parts to remove or insert. Just loosen the nut, insert conduit and tighten.

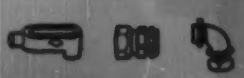
SUREST, SAFEST SEAL — Pressure from the nut compresses and coins brass sealing ring into nut and body and bends it in an arc. Brass sealing ring provides better sealing action than any other material.

HEAR AND FEEL IT GROUND WITH A "CLICK" — When conduit is inserted, convolutions on the grounding insert make intimate contact with those of the conduit . . . producing an audible click you can actually feel! Efcor Liquid-Tites maintain less than ten millivolts voltage drop.

sold exclusively through electrical wholesalers • send for sample and information

Efcor

Reg. Trade Mark



ELECTRICAL FITTINGS CORPORATION
37-50 57th St., Woodside 77, N. Y.

☐ Send literature ☐ Send sample

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Moisture and abrasion won't hurt tough Neoprene sheathed Rome 50 Cords. And a Rome 50 Cord is flexible, easy to handle.

It costs less to specify flexible cords that can take hard day-to-day use. Rome 50 Flexible Cords are properly designed for long service life.

You can tell a good flexible cord *by the company it keeps*. Thousands of feet of Rome Flexible Cords are in use as original equipment on the fine hand and floor model vacuum cleaners made by The Singer Manufacturing Company.

Measure the costs

Every time a flexible cord fails on the job, it costs you money—(1) money lost through job delay—down time—and (2) the expense of replacement.

If you use flexible cords frequently and use them hard, your best insurance against trouble is a durable Neoprene sheathed Rome 50 Cord. Correct design makes Rome 50 Cords flexible and easy to handle. And the inherent resistance to moisture, abrasion, oils, acids, flame and sunlight of the tough Neoprene sheath gives you the long cord life you need.

Rome 50 Flexible Cords are available in Types SO and SJO—economically priced.

Where service is unusually tough, it will pay you to check into the savings you can make with the extra heavy-duty cords and cables in the slightly higher priced Rome 60 line.

Contact your Rome distributor for service—Rome 50 for all around use—Rome 60 for extra heavy duty.

# of cord failure

The inherent toughness of a properly made flexible cord is your best assurance of long life. The all-resistant Neoprene sheath protects Rome 50 Cords against operating hazards.

TYPE "SO"—600 VOLTS					
SIZE A.W.G.	STRANDING	TWO CONDUCTOR		THREE CONDUCTOR	
		Approx. O. D.	Approx. Net Wt. Per M'	Approx. O. D.	Approx. Net Wt. Per M'
18	42/34	.40	95 lbs.	.41	105 lbs.
16	67/34	.41	100 lbs.	.43	120 lbs.
14	41/30	.53	160 lbs.	.56	200 lbs.
12	65/30	.60	215 lbs.	.64	260 lbs.
10	105/30	.64	250 lbs.	.69	325 lbs.

TYPE "SJO" FLEXIBLE—300 VOLTS					
SIZE A.W.G.	STRANDING	TWO CONDUCTOR		THREE CONDUCTOR	
		Approx. O. D.	Approx. Net Wt. Per M'	Approx. O. D.	Approx. Net Wt. Per M'
18	16/30	.30	53 lbs.	.33	70 lbs.
16	26/30	.33	63 lbs.	.36	86 lbs.

TYPE "SJO" EXTRA FLEXIBLE—300 VOLTS					
SIZE A.W.G.	STRANDING	TWO CONDUCTOR		THREE CONDUCTOR	
		Approx. O. D.	Approx. Net Wt. Per M'	Approx. O. D.	Approx. Net Wt. Per M'
18	42/34	.30	50 lbs.	.33	70 lbs.
16	67/34	.33	61 lbs.	.36	86 lbs.

It Costs Less to Buy the Best

ROME CABLE Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

See us at the 7th National Plant Maintenance and Engineering Show, Convention Hall, Philadelphia—January 23 to 26, 1956

heavier loads of expanded trolley system handled by WATERTITE-HAZAPRENE feeders

With 60 miles of scheduled routes for its trackless trolleys today, Wilkes-Barre Transit Corporation's need for dependable electrical power has increased substantially. To keep this power available, they have installed main feeder cables of Watertite-Hazaprene, replacing Hazard feeder cables that had become too small after 27 years of the transit company's growth.

Like the old lead-covered cables, the new Watertite-Hazaprene cables are installed in ducts under a bridge spanning the Susquehanna River. These cables are exposed to constant dampness and weather extremes. The original Hazard cable lived through two floods which submerged the bridge roadway.

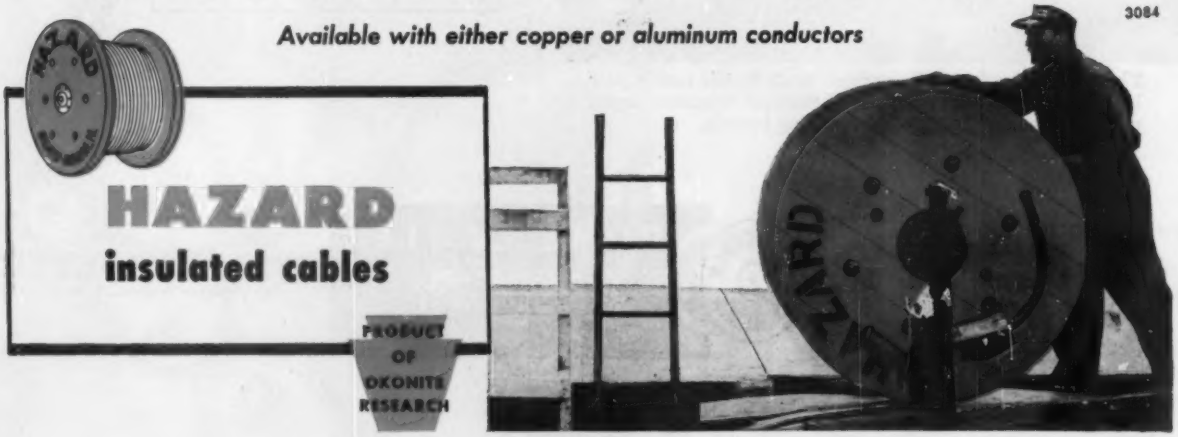
With a 27-year service record on the previous Hazard feeder cable, Hazard was the logical choice for its replacement. Combining the electrical and moisture-resisting properties of Watertite insulation with the remarkable weather-resistance of Hazaprene, Watertite-Hazaprene cable provides the dependability needed for this vital feeder circuit in an expanded system.

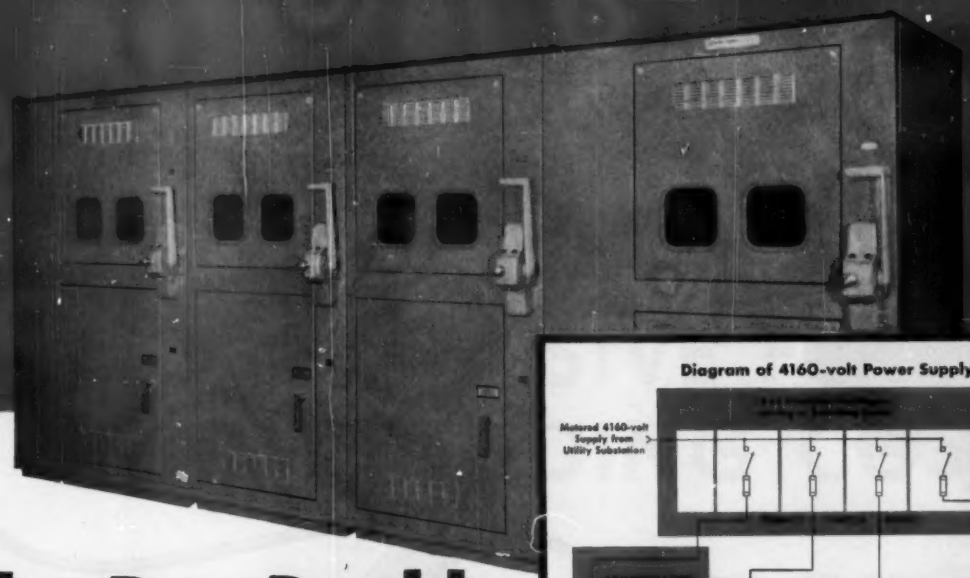
This is just one more example of the way Hazard cables prove themselves in on-the-job use...in new or replacement circuits that will provide adequate wiring for today's major industries.

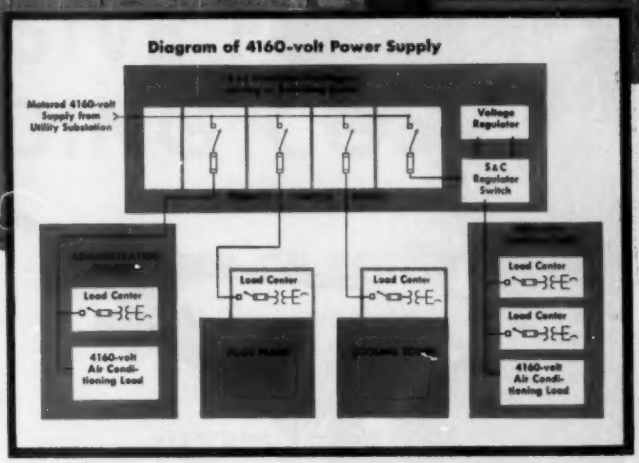
For full details on how Hazard cables can help you—not only today, but in the years ahead—write to Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, N. J.

3084

Available with either copper or aluminum conductors







Why Pay Double for Metalclad Switchgear for your High-Voltage Power Supply

CHARLES E. VANA, electrical engineer with E. R. Gritschke & Associates, personally supervised the design of Universal Oil Products Co.'s electrical system, and selected the components.

HIGH-voltage power supply systems in typical industrial and commercial installations are almost never exposed to transient faults. For that reason they can use the simple radial form of power distribution, and dispense with high-priced metalclad switchgear designed for automatic reclosure on faults. Reliable interruption of the infrequent permanent fault and occasional switching is all that is required.

When a new research laboratory building was added to the Universal Oil Products Co. plant in Des Plaines, Ill., a complete new high-voltage power supply system was installed for the entire plant. The S&C Metalclad Switchgear shown above serves as the 5-unit switching center. The diagram shows how it fits ideally into the simple radial circuit, thus eliminating the cost of complex equipment.

E. R. Gritschke & Associates, consulting engineers for the installation, recommended S&C Metalclad Switchgear for the switching center, to provide "completely adequate switching facilities and dependable protection." Architects for the job were Olsen & Urbain; the electrical contractor was Fries-Walters Company.

Specialists in High-Voltage Switchgear for Electric Utilities since 1910

S&C ELECTRIC COMPANY

4433 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U.S.A.

Consult your telephone directory. Sales offices in Birmingham, Boston, Buffalo, Chicago, St. Louis, Cleveland, Dallas, Dearborn, Denver, Houston, Huntington, Indianapolis, Jersey City, Kansas City, Little Rock, Memphis, Minneapolis, New Orleans, Philadelphia, Pittsburgh, Portland (Ore.), St. Petersburg, Salt Lake City, San Francisco, San Gabriel (Los Angeles), Seattle, Syracuse, Washington, D. C. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

NOW-get 90°

NEW S-130 BENDER — $189.00

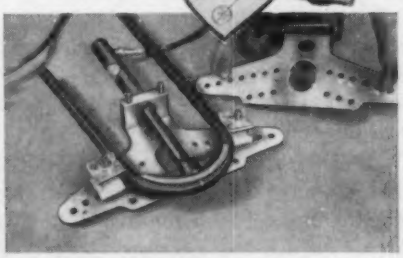
Pays for itself on first good job. Kit includes "Porto-Power" hydraulic unit with new 10-inch stroke. 10-ton hydraulic ram plus bending equipment for six sizes of pipe and rigid conduit. ½-inch thru 2 inches.

"OPTIK-ANGLE" GAUGE

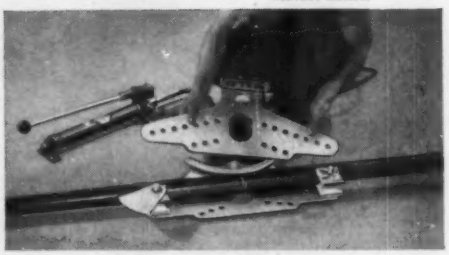
(Pat. Pending)

Prices subject to change without notice.

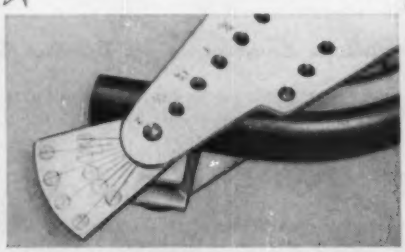
"FEATHERWEIGHT" PORTABILITY! Light but strong aluminum-alloy frame and shoes! Just a breeze to carry this bender around floor or overhead.



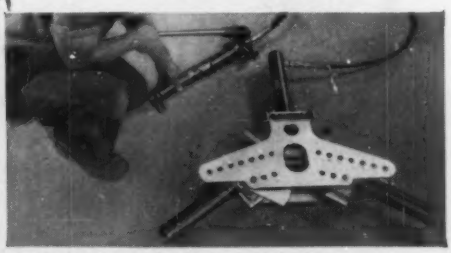
NEW, LONGER STROKE RAM! Extends to full 10-inches. Enables making 90° bends in one stroke. Also forms 180° bends quickly.



MAKES SETUPS IN SECONDS! Two pins unlock top plate. Pipe can be laid in from above. "Lock-on" shoes are switched in seconds.



ELIMINATES GUESSWORK, TRIAL FITTING! New exclusive "Optik-Angle" gauge records angle of bend (0° to 105°) as work progresses. It's mounted on the bender.



ALSO CORRECTS OVERBENDS! Motor-driven pump available for multiplying output of work. Ram adapts to standard "Porto-Power" attachments for lift, pull and other jack jobs.

bends in 1 setup!

NEW EXCLUSIVE FEATURES SLASH BENDING COSTS!

NEW "OPTIK-ANGLE" GAUGE

(*Patent Pending.*) At last . . . a fool-proof way to eliminate guesswork and time-wasting measuring in controlling degree of bend. The degree is constantly indicated by gauge that's mounted right on the bender.

NEW REMOVABLE TOP PLATE

This new feature makes it dramatically easy to set the shoes and position the pipe for the bending operation. There's no need to slide pipe in from the side . . . it's quickly laid in from above.

NEW LOCK-ON BENDING SHOES

No time-consuming threading of shoes on ram. Simply set shoes on plunger and pin in place. No threads to damage.

NEW "FEATHERWEIGHT" ALUMINUM ALLOY

Frame and shoes of this material are rigid and strong — yet lightweight for greater portability, easier assembly and maneuverability. Far less weight to lug around.

BENDS 6 SIZES OF PIPE AND RIGID CONDUIT

This new "featherweight" Blackhawk hydraulic bender revolutionizes bending methods. It obsoletes all other equipment for bending ½ thru 2-inch rigid conduit and pipe. Bends are made so perfectly at such amazing low cost that practically all need for expensive factory-formed ells is eliminated. All of this astounding speed, ease, lightweight and precision in bending are the result of a design which incorporates features asked for by electricians themselves. Check these advantages and you'll see why it's good business to put the new S-130 on your jobs right away! For immediate delivery or a demonstration, see your electrical wholesaler or industrial distributor today.

***NEW! NEW!* More time-saving Blackhawk equipment announced!**

Write for literature on "New Blackhawk Equipment for Electricians". You'll get facts on the new complete line of lightweight, low-cost hydraulic knock-out punch equipment . . . the new S-130 bender . . . plus big line of other Blackhawk hydraulic tools. Write BLACKHAWK MFG. CO., Dept. P-20125, MILWAUKEE 46, WISCONSIN

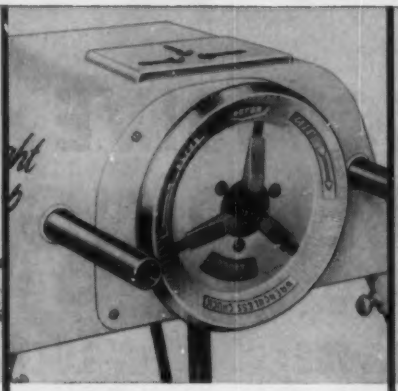
BLACKHAWK®

WORLD'S LARGEST MANUFACTURER OF HYDRAULIC TOOLS

CONTRACTOR THREADS PIPE 4 TIMES FASTER

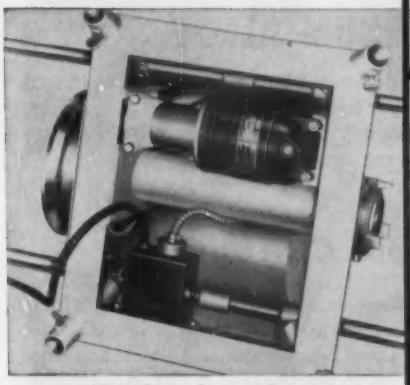
with the new OSTER No. 432 Lightweight Champ

1 "The time this 'Lightweight Champ' saves means time to handle more jobs and make extra profits. Take a look at some of the features that make this portable power drive a moneymaker for me.



2 "The new wrenchless chuck, for instance. A spin of the wheel, and it grips securely in *both* directions. No bar or chuck wrench needed here!

3 "With my hand tools converted to power tools, I cut off, ream and thread 1" pipe in 59 seconds. That's four times faster than I can do it by hand. Notice the vise-mount plate—it's universal—takes any make of pipe vise—another *exclusive* Oster feature.



4 "It takes plenty of power to make top-quality threads fast—and this machine has it in a new, more powerful motor. Universal, geared-head type, reversible, variable speed.

5 "Although all-steel construction makes the 'Lightweight Champ' practically indestructible, it's easy to throw on the truck and take to the job. I set it up, ready to work, in two minutes. No more hand threading for me!"

...the most DURABLE 2" portable power vise stand on the market!

Improved design, lighter weight, and more powerful motor make the new Oster No. 432 "Lightweight Champ" an even greater value than the famous No. 422 which preceded it. Standard range is ⅛" to 2" pipe; range with geared tools, 2½" to 12" pipe.

Get all the facts now by calling your nearby Oster Dealer, or write us direct for Booklet No. 432.

THE OSTER MANUFACTURING CO.

Main Office and Factory:

Box 4326-R • Cleveland 32, Ohio

New York Factory Branch Sales and Service, 25-36 Jackson Ave., Long Island City 1, N.Y.

BUILDERS OF COST-REDUCING THREADING EQUIPMENT SINCE 1893

WIRE BY PHELPS DODGE

Shown above are two of the four buildings recently finished for the Air Command and Staff School—largest school for the advanced education of Air Force officers—of the United States Air Force's Air University, Maxwell Air Force Base, Montgomery, Ala.

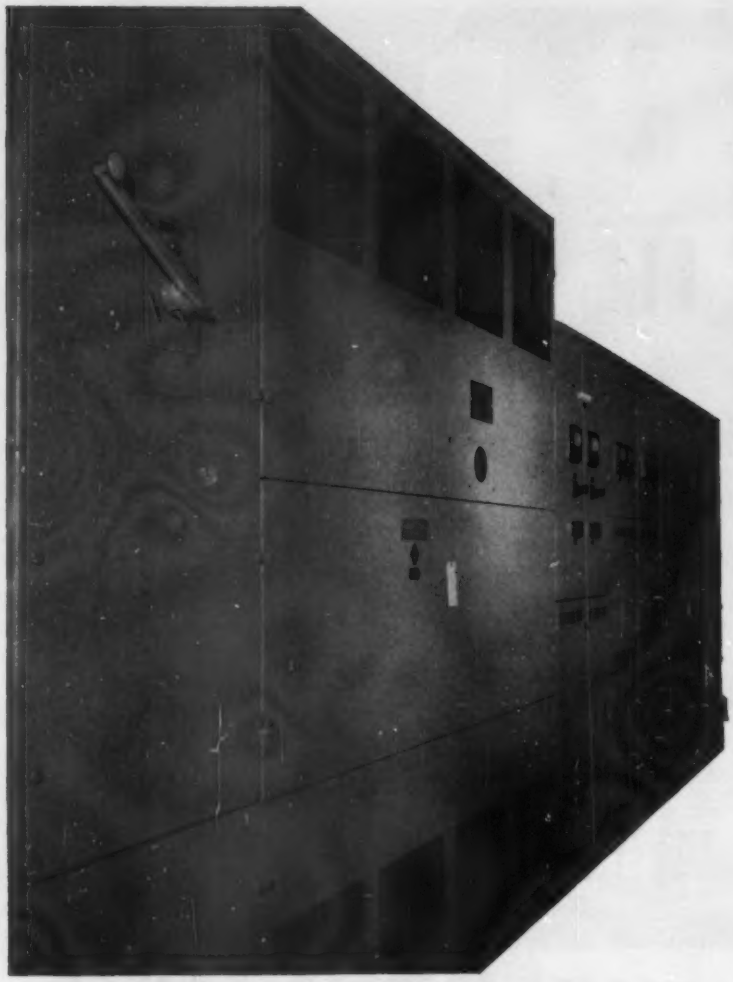
Reliable, long-life Phelps Dodge wire and cable, including Habirduct-Habirprene and Habirite-Habirprene, were specified and installed throughout all four buildings, which form the academic center of the famous Air Command and Staff School, to assure complete wiring satisfaction and trouble-free service.

* * *

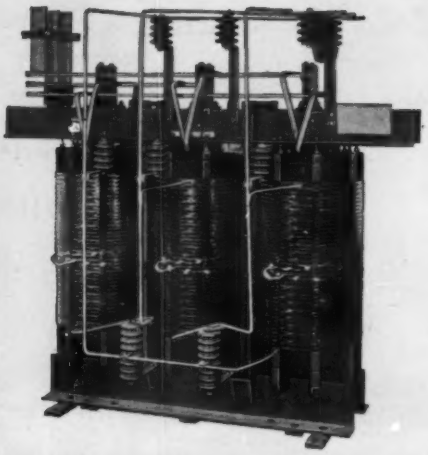
On every wiring job, large or small, where top quality materials, expert workmanship and experienced "know-how" are called for, *it pays to rely on Phelps Dodge and your Phelps Dodge distributor!*

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.



Wagner®
TRANSFORMERS
... the choice of leaders in industry



predesigned power for PACKARD

Studebaker-Packard's new facilities are planned for greatly increased productivity—and part of that planning is a modern electrical distribution system, with plenty of unit substations to put power where it's needed at the right voltage for use.

This 2000 Kva, 4800 to 480 volt unit substation feeds power to stamping operations for Packard. Its heart is a Wagner dry-type transformer like the one illustrated.

Wagner unit substation transformers are "Predesigned." This completely eliminates individual job engineering because the standard ratings in which they are built are coordinated with the specifications of every unit substation builder.

When you specify Wagner "Predesigned" transformers you get the advantages of a proved design in a completely assembled and tested transformer —you reduce your costs—and get quick delivery.

Wagner unit substation transformers can answer your power needs just as they do at Packard. Choose Wagner for your next load-center installation. Consult the nearest of our 32 branch offices or write for Bulletin TU-205. It gives full information on Wagner Unit Substation Transformers for industrial power distribution systems.

Wagner Electric Corporation
Electric Corporation
EST. WE 1891

Wagner Electric Corporation
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

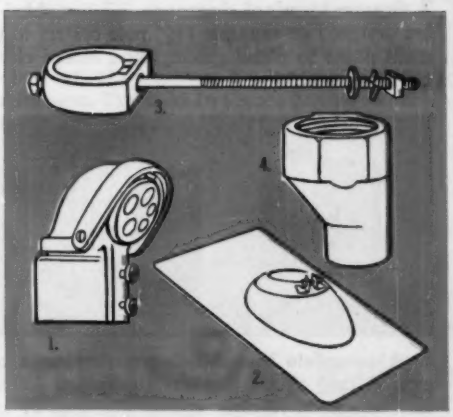
WT55-6

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

Hubbard Service Entrance Mast Kit

The new Hubbard Service Entrance Mast is your answer to the low roof service problem. Because it is designed to conform to the latest service entrance practices, local requirements can be met with a minimum of time and expense. Easily assembled with only a few electrician's tools, the installation is fast, weather-tight and permanent.

Two complete kits are available for use with 2-inch or 2½-inch conduit risers. Each kit contains Slip-fitter Entrance Head (1), Galvanized Roof Flashing (2), two Mounting Brackets (3), and Offset Reducer (4) for Meter fittings. All accessories necessary to meet local installation requirements are available and must be specified separat[illegible] For complete information write for copy of Bulleti[illegible]-1255.



HUBBARD AND COMPANY
Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Cal.

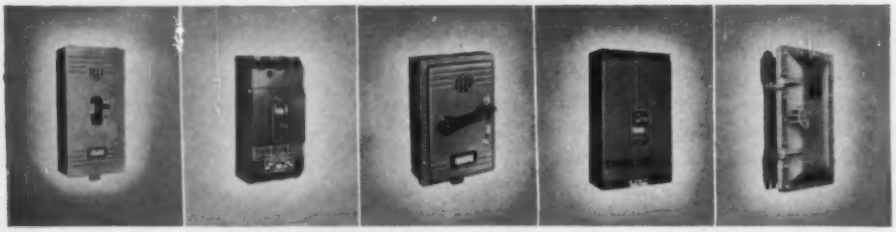
I-T-E Molded Case Circuit Breakers Offer You These Extra Values

1. Enclosed terminals. Provide maximum safety to personnel, yet permit ease of cable connection. All 600 v a-c rated I-T-E molded case breakers have enclosed line and load terminals.

2. External instantaneous trip adjustment. Accessible from front of breaker. Adjustment can be changed to desired setting after breaker is installed without removing cover or disrupting service.

3. Greater terminal clearance. I-T-E molded case breakers are designed on multiple 1½″ pole centers to provide maximum phase to phase spacings and reduce electrical leakage clearance problems.

4. Plug in mounting. I-T-E molded case breakers can be readily equipped with tulip clip adaptors and molded mounting block for maximum flexibility when changing and installing breakers.



5. A complete line. I-T-E manufactures a complete line of commercial, Navy and maritime molded case circuit breakers 10 through 600 amp, 600 v a-c, 250 v d-c. All are available with various special features and in all types of individual enclosures.

I-T-E CIRCUIT BREAKER COMPANY

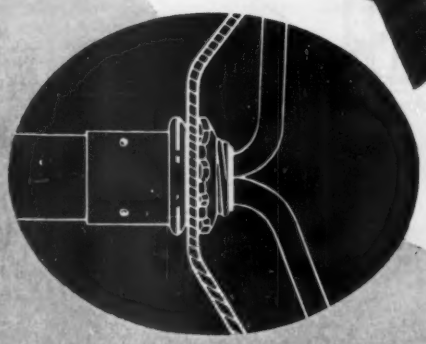
Small Air Circuit Breaker Division

Contact your I-T-E representative or authorized distributor for the Speedfax Catalog—containing complete information on all I-T-E circuit breakers and enclosures. Or, if more convenient, write Small Air Circuit Breaker Division, I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Red Throat

B-M 21 B, THE NEW INSULATED THROAT INDENTER CONNECTOR FOR E.M.T.

Four Ways Finer



1. Protruding rounded red plastic lip of bushing prevents cutting of insulation—eliminates shorts.
2. Full thread screws into all conduit fittings. Lip of RED THROAT bushing protects thread from damage.
3. Deep dished eight pronged lock nut is easier to drive on—screws flush to shoulder and digs into metal of box for vibration proof positive ground.
4. Permanent locked-in bushing insures smooth burr-free raceway for easy fishing. No extra work and costs no more.

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT

Order from Your Wholesaler!

All B-M Indenter Fittings are U.L. Approved as concrete-tight and for general use (File Card E10863). Also comply With Federal Specifications W-F-406.

UL

TELESCOPE BM SYSTEM

BRIEGEL METHOD TOOL CO.

GALVA • ILLINOIS

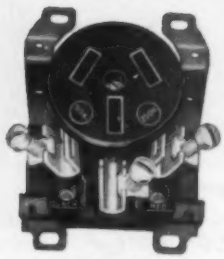
Warehouse Stocks in Principal Cities for Immediate Delivery!

These Bryant Wiring Devices

cut installation costs

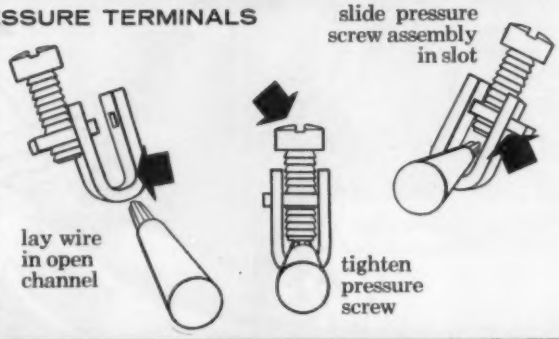
give faster, easier wiring

NO. 3845 WITH PRESSURE TERMINALS

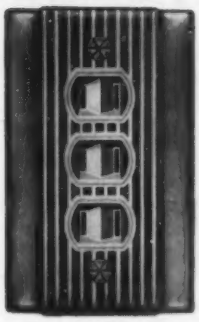


50 AMP. 250 V.

Left and right hand channels are set at an outward angle so that wire can be inserted *without* removing upper portion of receptacle. Screw assemblies are permanently attached to channels . . . no loose parts to get lost!

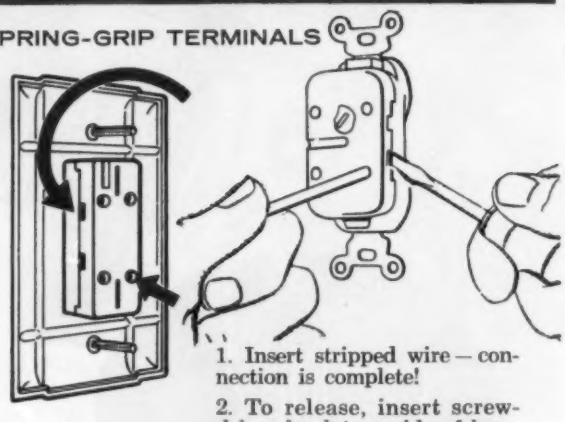


NO. 6123 AND 6100 WITH SPRING-GRIP TERMINALS



15 AMP. 125 V.

One step operation with these time - saving, cost - cutting screwless terminals . . . for easier, more efficient wiring jobs.



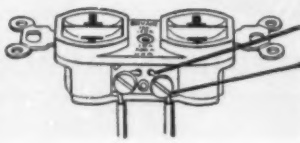
1. Insert stripped wire — connection is complete!
2. To release, insert screwdriver in slot on side of base.

NO. 4832 WITH HOLE SNUB WIRING

15 AMP. 125 V. 10 A. 250 V.

Snub-hole method of wiring assures a positive connection.

Easy wiring combined with the most secure way to attach conductors!



insert wire in snub-hole

bend around screw in front of lug

tighten screw

Listed by Underwriters' Laboratories Inc.

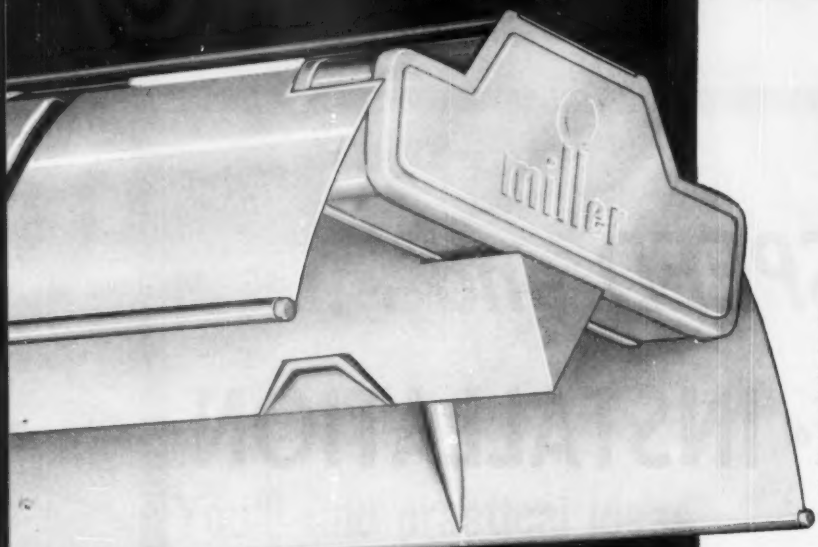
J-99945

BRYANT
SUPERIOR WIRING DEVICES

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

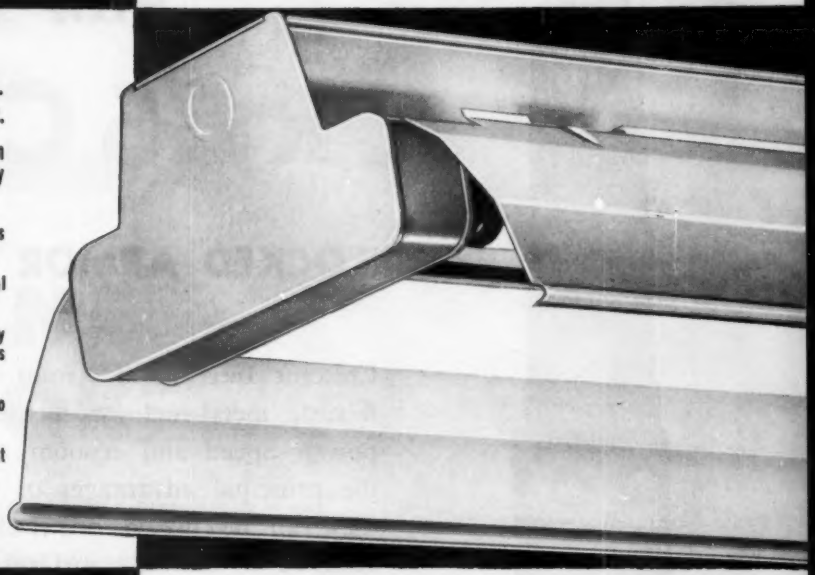
Chicago — Los Angeles



NEW MILLER INDUSTRIALS MEET OR EXCEED NEW RLM SPECIFICATIONS

Charted below are 12 of the most important advances in the history of industrial lighting: the new RLM specifications for fluorescent industrial lighting fixtures. The new Miller "Industrials" meet or exceed these specifications in every instance! And that's not all! Many other "extra quality" features make this one of the finest industrial fixtures ever produced —good reason why it always pays to specify MILLER!

- 4 foot reflectors on 8 foot channels for one man maintenance—easy cleaning and changing of reflector.
- Super-rigid reflector and V-channel are stamped in one piece—with sealed rolled bead flanges and heavy reinforcing ribs, lifetime porcelain enamel.
- Extra-sized wiring channel designed for sliding clamp hangers or surface mounting.
- Miller Socket Box construction for easy, economical individual socket replacement.
- Heavy gauge pressure connector provides fast and easy assembly in continuous rows with positive electrical grounding. No screws to align.
- Extra large man-sized captive nuts for mounting reflectors to channel. No tools required.
- Special reflector aligner keeps uniform row alignment—seals light leakage between reflectors.



New RLM Specifications for:	DIRECT	SEMI-DIRECT
1. ALL-WHITE PORCELAIN ENAMEL REFLECTORS (Inside and Outside)	Yes	Yes
2. INCREASED UPWARD LIGHT	5%-15%	20%-30%
3. MAXIMUM BRIGHTNESS	Yes	Yes
4. BETTER SHIELDING ANGLES	13°-14°	27°
5. HIGHER REFLECTION FACTORS	85%	85%
6. HIGHER LIGHT OUTPUT	83%	77%
7. CAPTIVE LATCHING and HOLDING DEVICE	Yes	Yes
8. GROUNDED BALLAST MOUNTING	Yes	Yes
9. CHANNEL DESIGNED for SLIDING HANGERS	Yes	Yes
10. REVISED LAMP SPACING	5"	
11. IMPROVED LAMPHOLDERS	Yes	Yes
12. ENTIRE UNIT RUST-PROOFED	Yes	Yes

RLM STANDARDS INSTITUTE *INCORPORATED*

4' and 8' for 40w Rapid Start Lamps
4' and 8' for 48" and 96" Slimline Lamps
4' and 8' for 48" and 96" High Output Rapid Start Lamps

miller

SINCE 1844

THE MILLER COMPANY
GENERAL OFFICES: MERIDEN, CONN.
FACTORIES: UTICA, OHIO—MERIDEN, CONN.
CURTIS LIGHTING OF CANADA LTD., TORONTO

you get SPEED and . . .

ECONOMY of INSTALLATION

with

CRESCENT

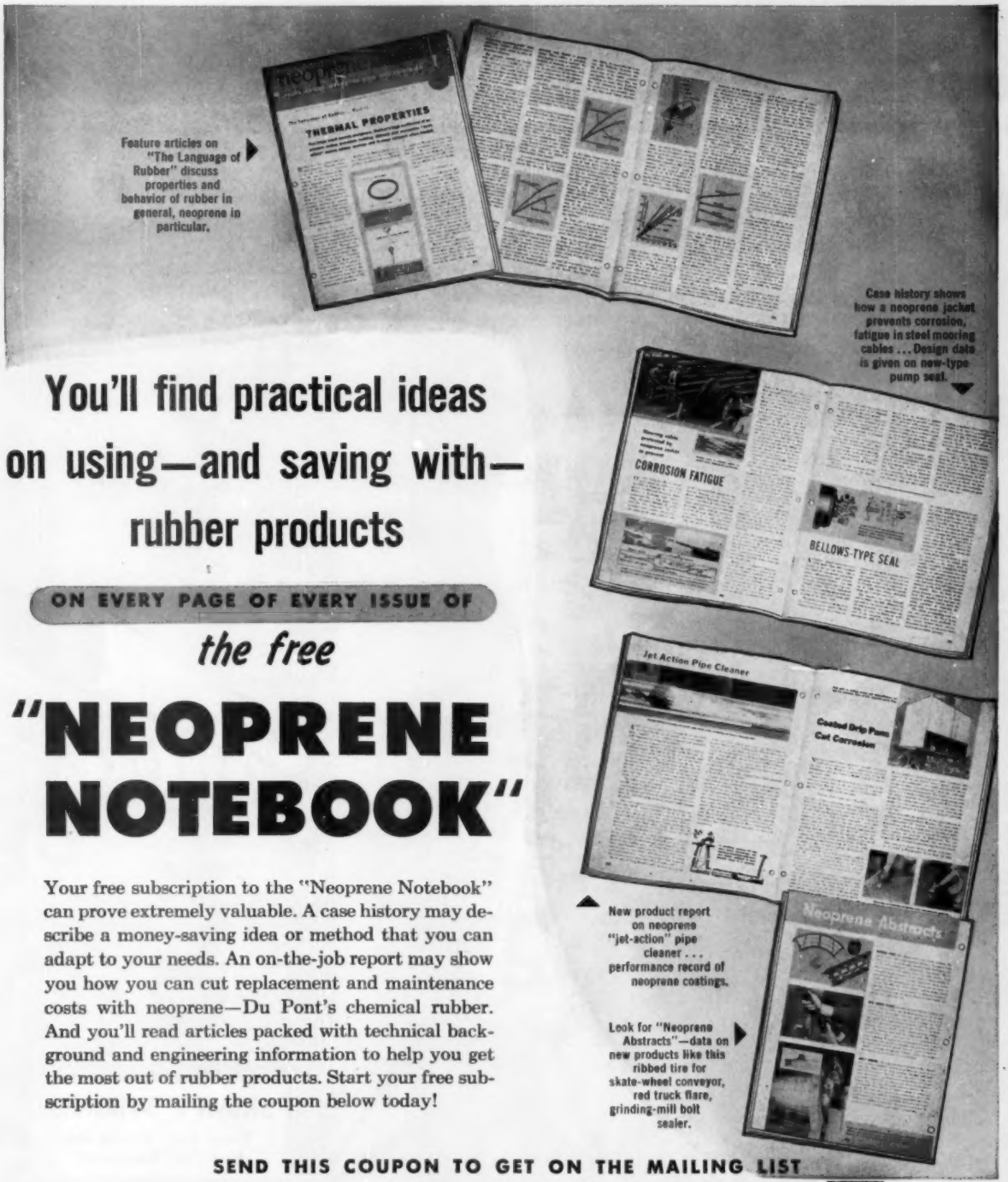
INTERLOCKED ARMOR POWER CABLE

THREE CONDUCTOR
VARNISHED CAMBRIC INSULATED

Crescent Interlocked Armor Cable provides a flexible metal-enclosed method of wiring for power. Speed and economy of installation are the principal advantages of these cables since they can be placed on easily hung racks or attached to building surfaces. This eliminates the fitting of raceways and cable pulling. On Secondary circuits much time required in bending and threading conduit can be eliminated. Maximum current carrying capacity is secured by the use of the varnished cambric insulation.

For Further Information
Write for Bulletin No. 854

CRESCENT OVER 70 YEARS EXPERIENCE
WIRE & CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, NEW JERSEY


Feature articles on "The Language of Rubber" discuss properties and behavior of rubber in general, neoprene in particular.
THERMAL PROPERTIES
Case history shows how a neoprene jacket prevents corrosion, fatigue in steel mooring cables . . . Design data is given on new-type pump seal.
CORROSION FATIGUE
BELLOWS-TYPE SEAL
Jet Action Pipe Cleaner
Coated Drip Pans Cut Corrosion
New product report on neoprene "jet-action" pipe cleaner . . . performance record of neoprene coatings.
Look for "Neoprene Abstracts"—data on new products like this ribbed tire for skate-wheel conveyor, red truck flare, grinding-mill bolt sealer.
Neoprene Abstracts

You'll find practical ideas on using—and saving with—rubber products

ON EVERY PAGE OF EVERY ISSUE OF

the free

"NEOPRENE NOTEBOOK"

Your free subscription to the "Neoprene Notebook" can prove extremely valuable. A case history may describe a money-saving idea or method that you can adapt to your needs. An on-the-job report may show you how you can cut replacement and maintenance costs with neoprene—Du Pont's chemical rubber. And you'll read articles packed with technical background and engineering information to help you get the most out of rubber products. Start your free subscription by mailing the coupon below today!

SEND THIS COUPON TO GET ON THE MAILING LIST

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division, EC-12, Wilmington 98, Del.

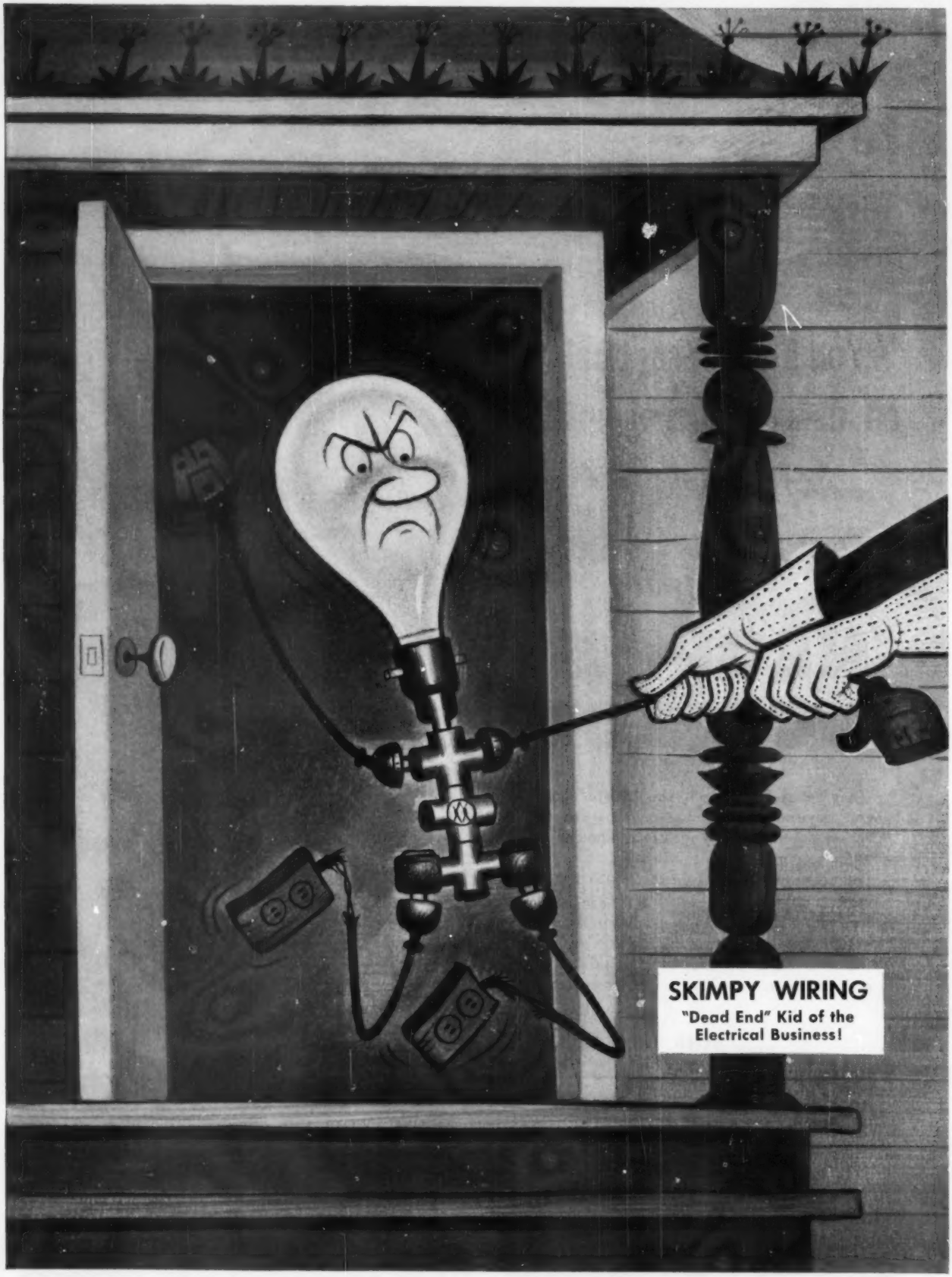
Please send me the free "Neoprene Notebook" regularly.

Name _____ *Position* _____

Firm _____

Address _____

City _____ *State* _____


SKIMPY WIRING
"Dead End" Kid of the
Electrical Business!

WE'RE PULLING HIM OUT OF HIDING!

Kennecott is exposing Skimpy Wiring...to help you sell more re-wiring jobs!

You know it... *we* know it. But few homeowners know that this Skimpy Wiring character is the real cause of most of the electrical troubles in their homes. However, once they recognize Skimpy Wiring for the villain that he really is, most homeowners will call you in to re-wire their homes properly. That's why Kennecott is running full-page national magazine ads like the one you see below.

These Kennecott ads drive home the story of safe, adequate wiring, tell readers to re-wire through *you* – their qualified electrical contractor.

It's a campaign bound to help the entire electrical industry, to build more wiring business for *you*. Tie in with it!

FREE! TIE-IN MATERIAL!

Send today for free reprints and poster-sized blow-ups of Kennecott Saturday Evening Post and This Week magazine ads. Get free copies of the educational booklet, "The ABC of Home Wiring." Ask for complimentary newspaper mat service folder, Home Wiring Wall Chart, and list of *at-cost* prices of available material. No cost, no obligation! Simply write Kennecott Copper Corporation, Dept. EC125, 161 East 42nd Street, New York 17, New York.

Kennecott Copper Corporation

Fabricating Subsidiaries: CHASE BRASS & COPPER CO. • KENNECOTT WIRE & CABLE CO

It takes just a handful

OF T&B LOCK-TITE CONNECTORS

to tap . . . terminate . . . or splice on all your jobs

1 Easy installation using only a standard key wrench.

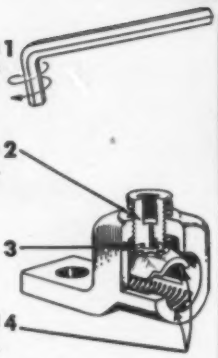
2 Fitting operates on screw-and-saddle principle.

3 Built-in lock washer keeps fitting tight.

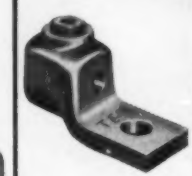
4 Serrated saddle and body for better grip.

5 Force applied here is greatly multiplied by leverage screw . . . gives tight all-around grip on cable.

6 T & B designed saddle securely holds large cables or small cables of all types.



T & B Lock-Tite fittings are engineered for long service . . . they cost you less to install—be sure to use them on your next job.



LOCK-TITE LUG

One-piece design holds all kinds of conductors: solid, stranded flexible, extra flexible, hemp core, rod, and tubing. Uniform all-around pressure means high conductivity. Only 7 sizes handle all cables from #4 solid to 1000 MCM.

LOCK-TITE TEE-PARALLEL TAP

A versatile, one-piece fitting for use as a tee, parallel, elbow, crossover, two-way, or reducing connector. Hinged top hooks over the "main"...lower opening holds the "branch". Only 13 sizes connect all combinations of "main" cable (1/0 to 1000 MCM) to "branch" cables (#2 to 1000 MCM).

LOCK-TITE TWO-WAY CONNECTORS

Neat and smoothly-rounded fittings for end-to-end connections. Cables are held by individual overlapping, serrated saddles. Each connector takes several cable sizes—you can use it as a reducer. The completed joint is small, streamlined, easy to tape. Only seven sizes handle all cables from #4 solid to 1000 MCM.

TWO other handy, T & B pressure connectors

HINJON JUNIOR TEE-PARALLEL TAPS

Compact, one-piece connector taps small branches to large mains. Self-adjusting jaws grip main and branch cables all around. To make a tee tap, just bend the branch wire at right angles. Installed easily with only a screw driver. Twelve sizes connect all combinations of "main" cables (#8 to 1000 MCM) to "branch" wires (#14 to #1).

LUGITS—Quickly installed terminals for small cables. Double thickness at the thread locks the screw in place. Copper tongue is serrated for positive grip on cable (sizes #14 to 4/0). Screwdriver tightened.

LOOK FOR THIS SIGN—

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T319

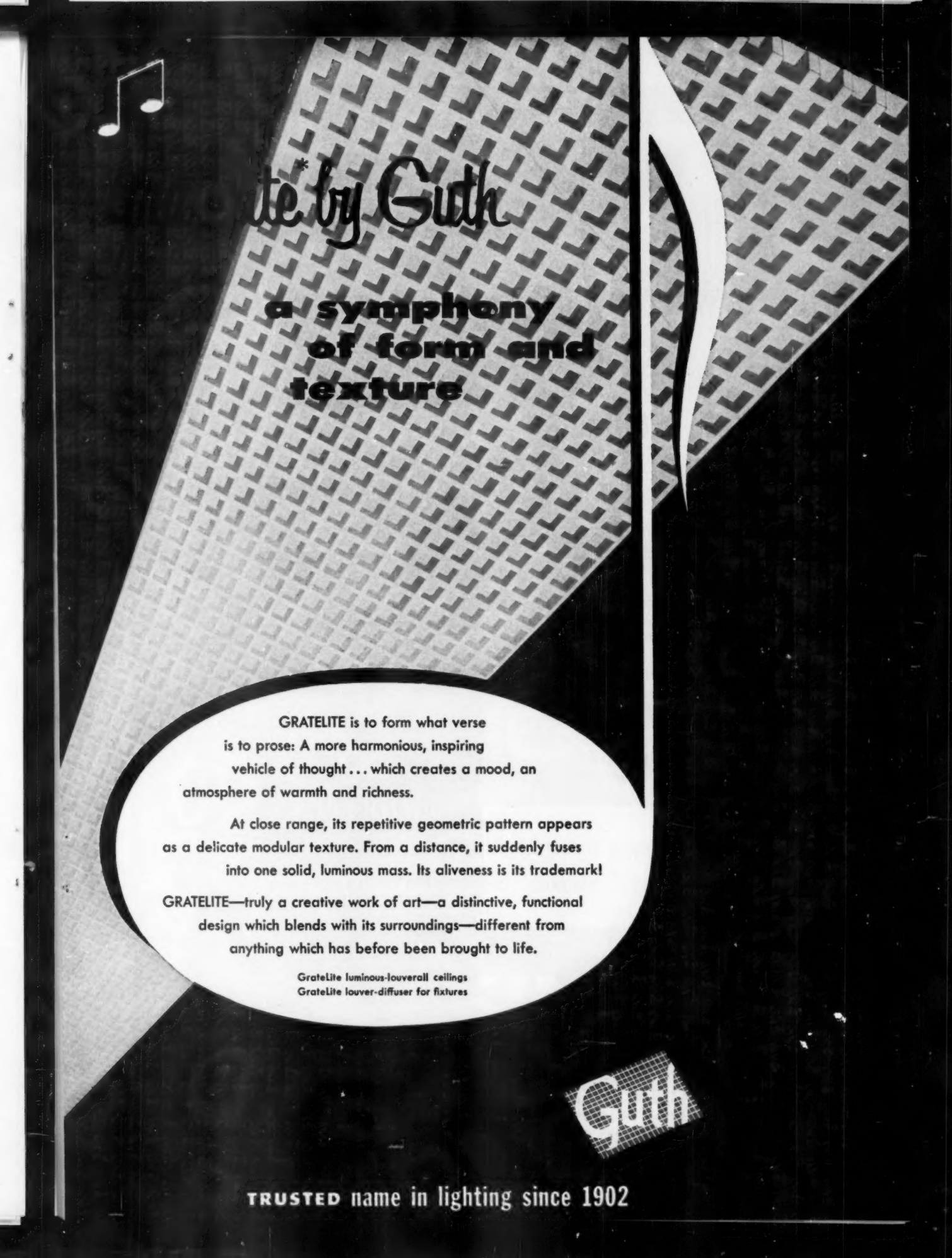
THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898


te* by Guth
a symphony of form and texture
GRATELITE is to form what verse is to prose: A more harmonious, inspiring vehicle of thought . . . which creates a mood, an atmosphere of warmth and richness.
At close range, its repetitive geometric pattern appears as a delicate modular texture. From a distance, it suddenly fuses into one solid, luminous mass. Its aliveness is its trademark!
GRATELITE—truly a creative work of art—a distinctive, functional design which blends with its surroundings—different from anything which has before been brought to life.
GrateLite luminous-louverall ceilings
GrateLite louver-diffuser for fixtures
Guth
TRUSTED name in lighting since 1902

Here's where you get the answers to conduit problems

●Look under "The Youngstown Sheet and Tube Company" in one of these alphabetical or classified phone books.

They represent the 28 conveniently located district sales offices Youngstown maintains across the country. Offices staffed by men who understand **your** problems and who are qualified to help you get the conduit you need.

If you aren't in touch now with a distributor of Youngstown Buckeye Conduit, just call the Youngstown district office nearest you and they will help you solve your conduit problems.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

a simple

one-word specification

for **conduit support**

This all-purpose system of support serves your every need . . . modular . . . with fewer parts.

KINDORF

A PRODUCT OF **STEEL CITY** ELECTRIC COMPANY

Send for our product bulletin C-1

PITTSBURGH 33, PA.

MILLIONS OF FEET NOW IN SERVICE

BECAUSE OF PROVED PERFORMANCE

ROCKBESTOS PNR SMALL DIAMETER CONTROL CABLE

There are still a few who haven't yet taken advantage of PNR . . . the lighter, smaller control cable. But it's come a long way since we first introduced its Polyethylene, Nylon, Rockhide insulation to industry just six short years ago.

Today, many utilities specify it. And there are millions of feet in service.

If you haven't tried it yet, get the complete PNR story today. Write or ask your nearest Rockbestos representative.

*Average determined by comparison with conventional control cable.

PROPERTIES OF PNR

46% smaller in area* . . . 28% smaller in diameter* than conventional control cable.
Use smaller conduit and fittings or put more conductors in existing conduit.
Lighter, easier to handle, store, ship, pull through conduit.
Dielectric breakdown . . . over 40 times operating voltage.
Rated 600 volts . . . conductor operating temperature 167°F.
Flexible from 167° to —67°F.
No cracking!

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONN.

NEW YORK • CLEVELAND • DETROIT
CHICAGO • PITTSBURGH • ST. LOUIS
LOS ANGELES • NEW ORLEANS
OAKLAND, CALIFORNIA

WAKEFIELD CEILING

Another Installation

A Wakefield Ceiling Greets Visitors to New Electronics Plant

When a large electrical company built a new plant and research laboratory for the design, development and production of military radar and electronic equipment, it designed the main lobby in contemporary style and topped it with a Wakefield Ceiling.

This is a good example of the use of a Wakefield Ceiling to provide a pleasant seeing-hearing environment in an area where first impressions are important.

Plexiglas diffusing panels distribute the light uniformly throughout the lobby. Acoustical baffles give a high degree of sound control. The whole ceiling is a canopy of light—simple, unobtrusive and in excellent taste.

There is an illustrated brochure on the Wakefield Ceiling which is yours for the asking. Why not write for one today?

Electrical Contractors:
Langdon and Hughes Construction Corporation, Utica, New York

NOTE TO CONTRACTORS: Means for air diffusion and sprinklers may be integrated with the Wakefield Ceiling, which is truly a multi-function ceiling. And all its components—the mechanical and electrical system, the diffusers, the baffles—are readily and speedily installed by an electrical contractor.

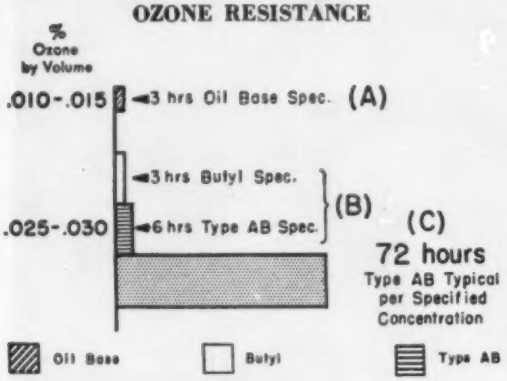
THE WAKEFIELD COMPANY
VERMILION, OHIO

WAKEFIELD LIGHTING LIMITED
LONDON, ONTARIO

3 tests show butyl rubber-

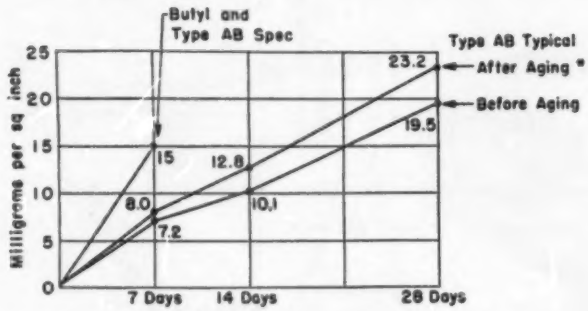
Extra protection against

OZONE RESISTANCE



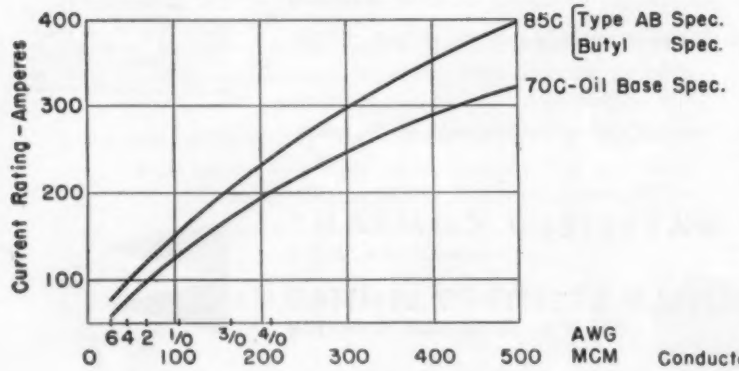
In standard ozone-chamber test, Type AB insulation showed no injury after 72 hours in 0.025-0.030% ozone concentration . . . 24 times longer than required by oil base and butyl specifications.

MOISTURE ABSORPTION



For the mechanical moisture absorption test, the industry has regarded 15 milligrams increase in weight per square inch of exposed surface, after 7 days' immersion at 70C, as a criterion for satisfactory moisture resistance. Type AB easily meets that requirement—in fact, after 28 days of immersion it is only a fraction above the 7-day requirement.

OPERATING TEMPERATURE



Anaconda recommends Type AB for operation at 85C maximum operating temperature. Industry standards recommend 70C for oil base. That means, as the graph shows, Type AB's current-carrying capacity exceeds oil base specifications by 22%.

insulated Durasheath* Cable has

ozone, heat and moisture

Anaconda exclusive Type AB butyl rubber insulation resists ozone far longer than needed to prove its high ozone resistance . . . absorbs far less moisture . . . has 22% more current-carrying capacity.

Standards are set up for your protection—but most standards state minimum requirements.

Anaconda's Type AB butyl-insulated cable performance exceeds its own specification requirements and goes far beyond industry requirements—gives you an extra margin of protection against the major enemies of long cable life.

Butyl rubber has *inherent* resistance to ozone, heat and moisture. Thus Anaconda has been able to concentrate on the development and improvement of other desirable properties.

The pay-off is in your operations—in longer cable life . . . in less maintenance . . . in lower over-all operating costs. The Man from Anaconda will be glad to give you full details about Type AB-insulated Durasheath and other Type AB-insulated high-voltage cable. Why not call him today? Or for more information, write Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U. S. Pat. Off.

55068

PIONEER IN BUTYL INSULATION **ANACONDA®**

Contractors Ronald Hamilton (left) and Ted Gower, of Hamilton-Gower Electric Company, Tampa, Florida

"We compliment Day-Brite on ease of installation"

"We, as Electrical Contractors, wish to compliment Day-Brite on the fine thought that goes into design and manufacturing of Day-Brite equipment, especially in regard to ease of installation.

"Recently we had the pleasure of installing Day-Brite Lighting Equipment in the new warehouse and offices of Raybro Electric Supplies, Inc., Tampa, Florida. All of the equipment was promptly received as ordered, and the installation went just as it was laid out by the engineer.

"We are always pleased when we receive a contract for furnishing and installing Day-Brite equipment."

This letter, signed by R. J. Hamilton of Hamilton-Gower Electric Co., voices the feeling of thousands of contractors throughout the United States.

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

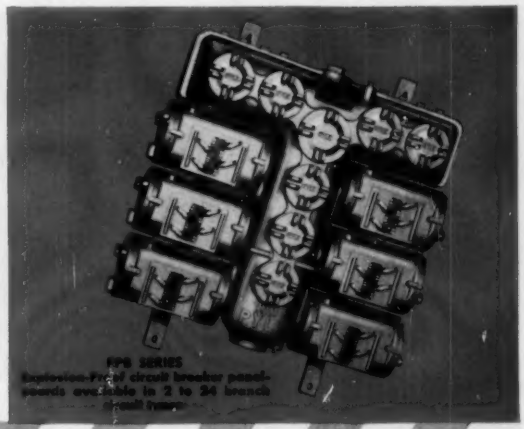
Day-Brite Lighting, Inc.
5402 Bulwer Ave., St. Louis 7, Mo.
In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario

5497

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

SPECIFY...

PYLETS®



FPB SERIES
Explosion-Proof circuit breaker panelboards available in 2 to 24 branch circuit types.

FOR HAZARDOUS LOCATIONS

Second to none for...

SAFETY: Explosion-proof and dust-tight PYLETS *exceed* code requirements and provide maximum protection for personnel and property against fire and explosion.

ECONOMY: PYLETS are designed for quick, easy installation and convenient maintenance. Rugged construction insures a long service life.

- TAPER TAPPED HUBS
- SMOOTH, ROOMY INTERIORS
- QUICK ACTING JOINTS
- DEPENDABLE MECHANISMS
- ALUMINUM ALLOY OR HEAVY CADMIUM PLATED FERROUS ALLOY CASTINGS

Sold Nationally Through Authorized Distributors
Literature furnished on request

SINCE 1897

THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1344 North Kostner Avenue, Chicago 51, Illinois

District Offices and Representatives in Principal Cities of the United States • Canadian Agent: The Holden Co., Ltd., Montreal
Export Department: International Railway Supply Co., 30 Church St., New York

CIRCUIT CONTROLS • PLUGS AND RECEPTACLES • LIGHTING FIXTURES • FLOODLIGHTS

Constitution Hall, Washington, D.C.

(DAUGHTERS OF THE AMERICAN REVOLUTION)

•

RELIGHTED BY RAMBUSCH UNDER THE SUPERVISION OF
BERNARD LYON FRISHMAN & ASSOCIATES, *Architects* • L. WARREN BOGAN & ASSOCIATES, *Consulting Engineers*

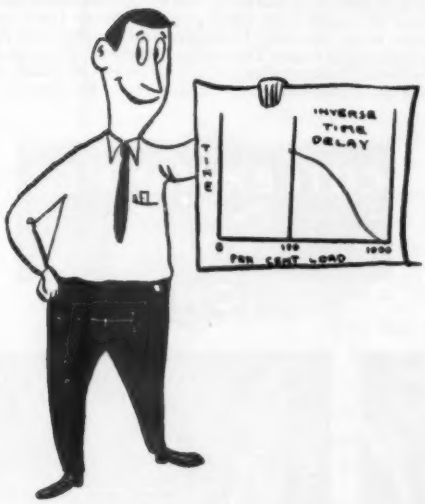
When it comes to lighting large and lofty interiors the Rambusch Downlite has no equal. It is efficient, safe, economical, simple to maintain, glare shielded and guaranteed to produce the promised results. • There are 100 Rambusch lighting representatives in the country—one of them is near you and anxious to serve you.

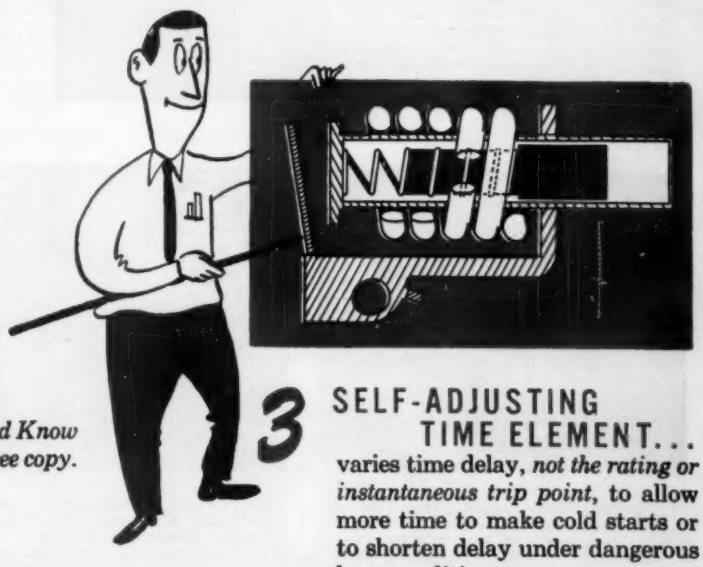
RAMBUSCH DESIGNERS • MANUFACTURERS
40 WEST 13th STREET, NEW YORK 11, N. Y.

ONLY HEINEMANN CIRCUIT BREAKERS give you all THREE

1 A DEFINITE RATING . . .
unaffected by temperature. A 20 ampere rating means 20 amperes of safe, usable capacity. There is no de-rating of Heinemann Circuit Breakers.

2 INVERSE TIME DELAY . . .
prevents nuisance power interruptions . . . permits starting inrush and harmless, temporary overloads. Gives maximum protection without inconvenience.





3 SELF-ADJUSTING TIME ELEMENT . . .
varies time delay, *not the rating or instantaneous trip point,* to allow more time to make cold starts or to shorten delay under dangerous heat conditions.

INFORMATIVE BOOKLET: *"What You Should Know About Circuit Breakers"... Send for your free copy.*

HEINEMANN *Circuit breakers*

HEINEMANN ELECTRIC COMPANY
132 PLUM STREET
TRENTON 2, N. J.

Star studded with economy features

New Cutler-Hammer Three-Star Unitrol

Standardized Modular Construction

All control units are 20" wide and in multiples of 14" in height. This permits easy interchange of various sizes and types of control units without rearrangement of the entire control assembly and avoids wasting space with dead panels to adapt non-uniform control units. This standardized modular construction also insures good appearance at all times because horizontal lines match.

No industrial today can afford to ignore the savings Unitrol now offers in the installation and use of motor control

The new Cutler-Hammer Unitrol cuts costs from the moment it is delivered. It can save days, often weeks, in the time required for the installation of motor control. The high cost of mounting and wiring individual starters is eliminated. Earlier use of the production facilities brings a speedier return on the investment. Unitrol often effects vital savings in floor space, sometimes avoids the need for costly plant construction.

In performance, nothing can compare with the new Unitrol. Feature after feature of the astounding new Three-Star Control saves time and expense. Superlife vertical contacts *never* require maintenance care in all normal use. Adjustable overload relay coils let motors work harder safely, save the expense of both damaged motors and needless production interruptions. Full three-phase protection such as able engineers now demand is offered by three-coil overload relays.

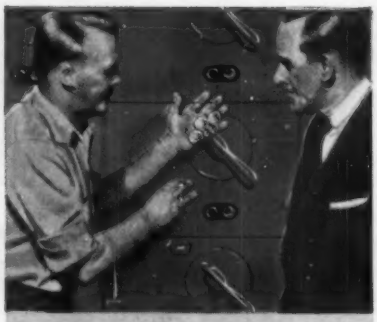
Compare the new Unitrol with any other control centers and see the difference. See how sizes and types of control units can be interchanged in Unitrol without rearrangement of the entire assembly or the waste of space with dead panels. Saves time, saves space, saves money. Compare and you *too* will insist on Cutler-Hammer Three-Star Unitrol. Write or wire *now* for full information. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

CUTLER-HAMMER

UNITROL

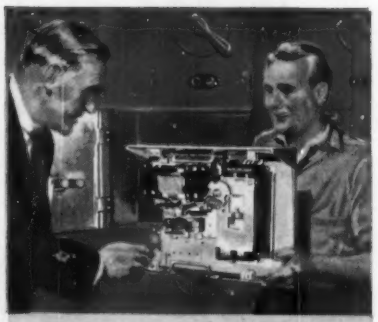
C-H

Uni-Plug disconnects control from power when unit is moved to test position, reconnects without misalignment when unit returns to operating position. Control panel is *always* vertical. Uni-Plug design permits back-to-back assemblies without staggering control units. Units are removed by merely disconnecting load and control wiring at terminal boards. This wiring is cabled, marked and color coded.



Unitrol provides either circuit breakers or fused disconnect switches of advanced design. Both have three-position self-aligning operators arranged for padlocking with as many as three locks in the "off" position. Recessed pushbuttons and concealed door hinges are typical features that add to safety and fine appearance.

The name UNITROL is a Cutler-Hammer trade mark



Components front of panel mounted without stacking. No crowding, no power connections near panel fasteners. Many Three-Star Control exclusives. Superlife vertical contacts *never* require maintenance expense in all normal control uses. Adjustable overload relay coils let motors work harder with safety. Full Three-Phase Protection with 3-Coil overload relays on standard size starter panels.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

55th Year—DECEMBER • 1955

Management Resources

Not in many years have the year-end reports been so optimistic about future business prospects. The McGraw-Hill survey of plans for capital expenditures on plant and equipment shows '56 will be up a startling 30 percent in the manufacturing industries. The Department of Commerce forecasts construction up 5 percent for '56.

Electrical construction and installation projects are inherently related to planned construction and capital expenditures. The outlook is excellent. Other good signals are the growing number of major commercial modernization jobs to provide for air conditioning and modern lighting. Then there are signs of a break-through in residential rewiring in many communities.

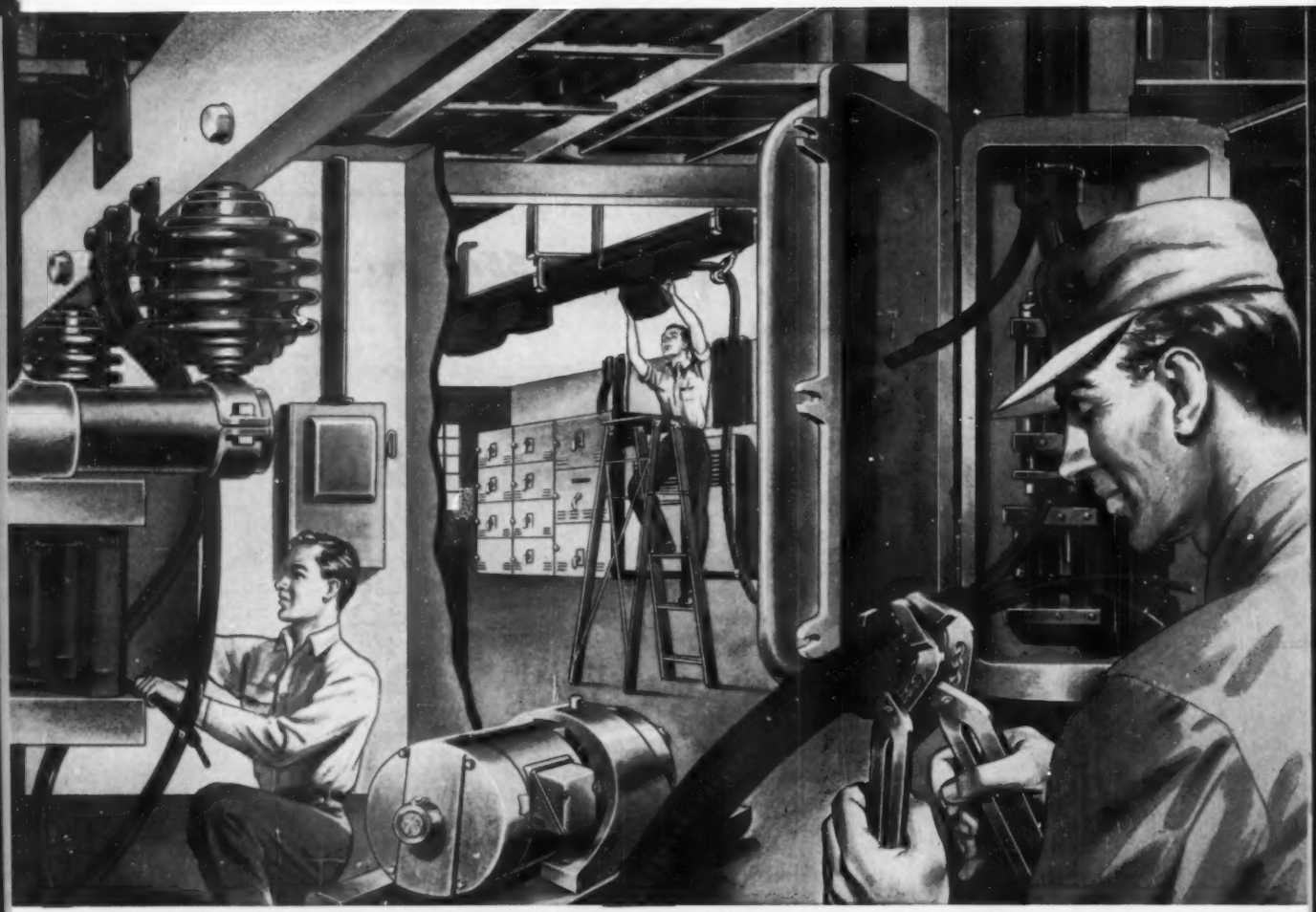
Some aspects of the outlook are not so rosy. Manpower resources for electrical construction are already extended. More business in '56 will take more man-hours, presumably the productive time of skilled craftsmen. But the number of trained electricians is limited and cannot be quickly expanded.

Expansion of engineering, technical and supervisory personnel presents an even more difficult problem. Shortages in these categories do not necessarily show up as acute and immediate troubles. They only reduce capability to serve customers and prospects at advanced levels of technology and management efficiency.

The favorable business outlook for 1956 suggests that this may be an appropriate time to take an analytical look at personnel and management resources. How much scarce and valuable brain power is being wasted on non-selective estimating and bidding? Would the same skills, experience and effort devoted to creative sales-engineering produce a higher return? The answers won't necessarily be the same for every contractor but they are certainly worth exploring.

The electrical contractor occupies a key role in an expanding industry. His management practices, personnel and facilities can influence the progress of electrification in many important ways. He cannot carry out his responsibility solely by bidding low and executing uncritically any specification regardless of design or application. He cannot expect to enjoy the rewards of industry progress unless he is a willing and devoted instrument of that progress.

Wm. T. Stuart



Power distribution systems that can effectively handle future demands are the surest way to avoid electrical obsolescence and costly rewiring.

Local Graybar Representatives will work with you and your customers in the selection of wiring and equipment to meet today's needs . . . and tomorr w's.

"Plan in" future plant flexibility . . . today

FREE booklet tells how BUStribution provides for today and tomorrow

Bulldog BUStribution is today's most efficient, most modern electrical distribution system. It provides the utmost in plant layout flexibility: 1. Allows simple easy changes as machinery is moved about. 2. Will meet demands of newly installed, high production, automatic machinery. BUStribution flexibility and economy are fully explained in this illustrated booklet. Write Graybar. Request Bulletin BD-750.

Planning extra power capacities for future expansion is an important consideration in new plant construction. Today's pressure of electrical growth often outstrips power-carrying capacity long before the equipment itself becomes outmoded. This then, is the most important reason why it pays to call Graybar *first* for planning aid on any wiring job. A Graybar Inside Construction Specialist can not only help you determine a power-distribution system to satisfy your customer's present and near-future needs, but also to "plan in" flexibility for long range expansion.

Over 100,000 different electrical items are distributed by Graybar through its nation-wide system of offices and warehouses. Complete catalog and quotation service covering them is available to help you work out job estimates and specifications — for lighting, power, control, ventilation, communications, as well as wiring. 463-412

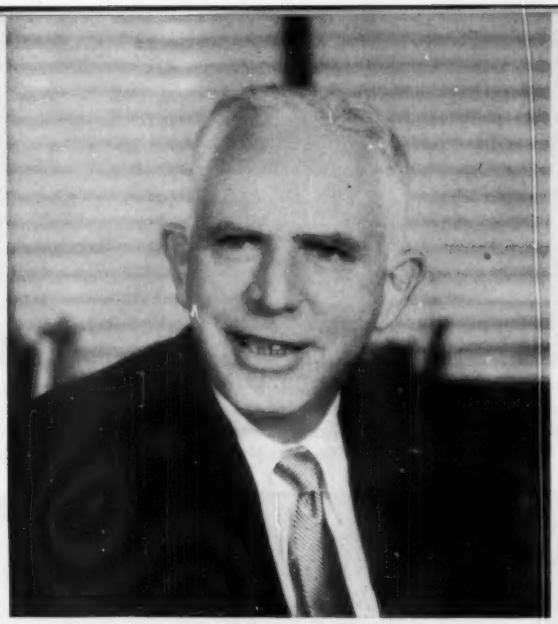
CALL GRAYBAR FIRST FOR...

GraybaR Everything Electrical

GraybaR **ELECTRIC CO., INC.**
420 Lexington Ave., New York 17, N. Y.

IN OVER 120 PRINCIPAL CITIES

ELECTRICAL CONSTRUCTION AND MAINTENANCE



OLIVER F. BURNETT, JR., Kelso Burnett Electric Co., Chicago, Ill. is named NECA president for 1956-57 term.

NECA Convenes in New York

Meetings and trade show attract members and guests to 54th annual convention.

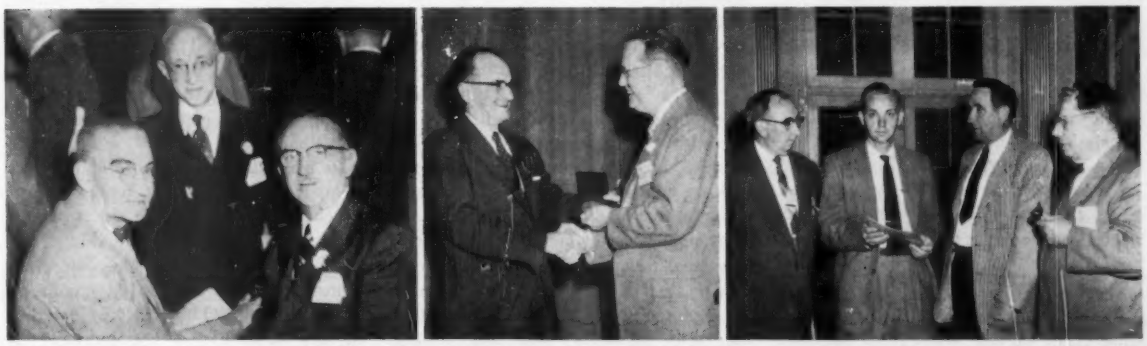
THE 54th annual convention of the National Electrical Contractors Association met October 31 through November 4 at the Waldorf-Astoria. Registration exceeded 2300, including 1400 members. An electrical products exhibit was held in conjunction with the convention in which 62 electrical manufacturers displayed their products.

From its opening keynote the convention outlook balanced heavily on the side of optimism, for members and for the industry. Its theme, "Modernize . . . Electrically" marked the growing business potential in the rewiring of existing structures. There were encouraging reports on atomic power and automation affecting business opportunities for electrical contractors.

Even the problems discussed were predominantly industry ills and inequities aggravated by growing needs for the specialized goods and services of the electrical contractor. Such matters as apprentice training, labor force, estimating practices, and marketing methods become more acute in the high-volume-level, high-opportunity-level complex of the current business scene.

KEYNOTE

In the president's opening address, Don B. Clayton, Sr., emphasized the huge requirements for electrical contractor services in new construction, modernization and automation. He also bluntly warned the copper industry that it was pricing itself out of the market and, unless supply became more dependable and prices lower, the



LEFT TO RIGHT—C. C. Nash, Whiffen Electric Co., White Plains, N. Y.; Louis Freund, I. Gaynor, Inc., New York City; John Doris, John Doris Inc., New York City; D. B. Clayton, Sr., Pres., NECA, Electric Constructors, Inc., Birmingham, Ala., receives Electrical Contractors Medal, James H. McGraw Award, from H. A. Webster, T. Frederick Jackson, Inc., New York City; E. B. DeFeyter, Power City Electric, Spokane, Wash.; F. J. Oertli, Jr. and Sr., Guarantee Electrical Co., St. Louis, Mo.; and Leo Gamp, Gamp Electric Co., St. Louis, Mo.

LEFT TO RIGHT—W. W. Hanks, Southern Electric Service Co., Charlotte, N. C.; C. R. Wright, Wright-Cason Electric Co., Knoxville, Tenn.; W. R. Truland, Walter Truland Corp., Arlington, Va.; Maurice Womack, Bales & Womack, Inc., Atlanta, Ga.; Dudley Traylor, Canterbury Electric Co., Birmingham, Ala.; W. H. Axelson, Youngstown, Ohio; C. W. Whitmore, Whitmore Electric Co., Miami, Fla.; L. P. Harvey, Schoolfield-Harvey Electric Co., Charleston, W. Va.

LEFT TO RIGHT—G. C. White, Empire Electric Co., Ft. Worth, Texas; Robert Moser, Moser Electric Co., Ft. Worth, Texas; C. L. Scharfe, Sr., J. W. Frommer, L. K. Comstock, and G. E. Stewart, all of L. K. Comstock & Co., New York City; E. C. Carlson, Carlson Electric Co., Youngstown, Ohio; C. A. Langlais, Sr., Charles A. Langlais Co., San Francisco, Calif.

electrical industry would look with increasing favor upon aluminum as an electrical conducting medium.

Referring to the Convention theme, "Modernize . . . Electrically", Mr. Clayton stated that home owners are buying an increasing flood of appliances to save time and labor, yet they are slighting the basic item which is essential to efficiently operate those household aids, i.e., wiring.

The advent of automation will increase the contractor's importance, he stated, because it will require more and better trained electricians, more engineers, qualified service and repair crews. This need indicates the importance of apprenticeship training, he concluded, because the existing labor force will have retired during the next 20 years, and at least 24,000 apprentices constantly in training will be needed to make up this labor-loss.

ATOMIC POWER

Lieut. Gen. Leslie R. Groves, wartime chief of the Manhattan Atomic Project and present vice president of the Sperry Rand Corp., reviewed the development of nuclear power stating that no one knows with certainty whether future atomic generation stations will be large central plants or numerous local smaller units. However, since the supply of uranium is great and supplies of conventional fuels are diminishing, this new source of power will permit vast electrical expansion.

BUSINESS

Executive vice president Paul M. Geary stated that the volume of business performed by electrical contractors during the past year had resulted in a total productive payroll of over $700-million. He also mentioned that the price rise in some lines had brought pressure on the contractor to obtain firm price commitments on bills of materials for specific jobs where bids are competitive but where delivery is for a future date.

In reporting on membership, secretary-treasurer Clint J. Harder mentioned that NECA now has a total of 3521 members, with 109 chapters. He also reported that the assets amounted to nearly $868,000; dues for the past 9 months had exceeded $758,000, and net expenditures during this period were less than $504,000.

MODERNIZATION

Jack Doscher, director of Operation Home Improvement, discussed the very big role which the electrical contractor will play in a nationwide home fix-up campaign which is set for 1956. This campaign has been named "Operation Home Improvement", and will be launched January 1, 1956. Albert Cole, Housing and Home Finance Administrator will at that time designate 1956 as Home Improvement Year. The campaign is designed to complement the ACTION program (the American Council to Improve Our Neighborhoods) and to convert public acceptance of the program into business for the construction industry.

William H. Lehmann, manager of sales training for the General Electric Company, spoke on the important job which contractors have in training their salesmen. He pointed up the relation between capable, effective salesmen and growth of a company, titling his talk "The Key to Growth". In the days ahead, an increase in competition will be best met by those contractors who have properly trained their salesmen in all aspects of the business.

Bert Jirovec, NECA, E. G. Jacobs, Service Electric Construction Co., both from Cleveland, Ohio; E. T. McGovern McGovern & Sons, Inc., Pittsfield, Mass.; T. K. Haswell Electric Co., Pittsfield, Mass.; Harry Heyman, Standard Electric Co., Springfield, Mass.; A. L. Berg, Berg Electric Corp., Los Angeles, Cal.; R. A. D. Schwartz, Schwartz & Lindheim, Oakland, Cal.; C. J. Kunsman, Fischbach & Moore, Inc., Atlanta, Ga.; Louis Kalischer, Fischbach & Moore, Inc., New York City.

George A. Harter, Santa Clara—San Benito Chapter, NECA, San Jose, Calif; Jack Ellis, Vallejo, Calif; Robert Hydon, Hydon-Brand Co., Detroit, Mich.; Earl Surrell, Albert Kahn, Inc., Detroit, Mich.; E. O. Dorsch, E. O. Dorsch Electric Co., St. Louis, Mo.; C. W. Paige, Kansas Chapter, NECA, Topeka, Kansas; C. R. Shrake, Shrake Electric Co., Topeka, Kansas; J. W. Slaughter, S & S Construction Co., Olathe, Kansas.

P. Howard Farley, Sales Promotion Manager of NECA, discussed tests which were conducted on the effectiveness of different types of advertising in stirring homeowners to buy electrical modernization. This included local newspaper ads and direct mail campaigns. After the ads were run a consulting firm was hired to analyze the reaction of the public to the ads. It was found that the use of "scare" themes—"fire in the home due to poor wiring", "danger from shocks" and "damage to appliances because of low voltage"—was not only ineffective but was actually objectionable to the average homeowner. And the offer in an ad of a "free check-up of the electrical system in your home" was considered a "trap" by homeowners. A straightforward, simple statement to the effect that "your electrical system is probably not good" was effective in the test ads. The prestige value of a well-wired home is also a potent sales tool.

GOVERNMENT

George B. Roscoe, director of public relations, reported on the campaign against "bid shopping" and "bid peddling". The Federal Construction Contract Act was introduced on April 1 by Senator Harley M. Kilgore, W. Va., and 16 other senators of both parties. On July 27, the bill was passed. This bill and five companion House bills will be pending before the House Judiciary Committee when the second session of the 84th Congress reconvenes in Washington on January 3, 1956.

PROFITS

Donald E. Denton of the American Trust Company, Charlotte, N. C. spoke on profits in construction. After reviewing the volume and growth of new building construction, which he said is currently averaging about $170 million a day on the basis of a five-day week, he said electrical construction work is plentiful and predicted it will continue to be. Therefore, it is not necessary to take work without a profit in order to keep working, he said.

Col. Charles P. Bobe of St. Louis, Chairman of the Research Committee, took a searching look at electrical contractors and what they are doing to lift themselves out of the profit-destroying and business malpractice of bidding below cost, and outlined sound methods of "Job Management for Profits".

RESEARCH

Milton R. Minto, member of the Research Committee, of MacNutt Electric Co., Inc., New York City, reported on the impact of operating expenses on profit, or "Operation Overhead"—results of a survey of some 400 electrical contractors.

The data reveal that the smaller contractor has the higher overhead, and that the percentage of overhead decreases as the volume of business increases, Mr. Minto stated.

Labor costs were analyzed and discussed by James Dandelake, Miller Electric Co., Jacksonville, Fla. He described a progressive job labor analysis and outlined how it is made in a step by step procedure. It was based on a segregated estimate, and supplemented by a weekly time card through which actual labor costs are obtained and compared with the estimates.

The chairman of the Codes and Standards Committee, W. H. Biester, Jr., Electro Construction Co., Philadelphia, Pa., reported on Code devel-

LEFT TO RIGHT—A. M. Burnett, Crescent Electrical Co., Kansas City, Mo.; William Wachter, Wachter Electric Co., Kansas City, Mo.; Charles Owsley, North Kansas City Electric Co., North Kansas City, Mo.; W. J. Wheeler, Mainco Contracting Corp., New York City and J. D. Richardson, Richardson-Wayland, Roanoke, Va.; Alvin Mueller, Dwyer Electric; Fred Vanderlinde, Vanderlinde Electric Corp.; E. G. Molz, Hickson Electric, all from Rochester, N. Y.; E. G. May, Albany, N. Y., and A. G. Hillebrand, Hillebrand & Owen, Syracuse, N. Y.

LEFT TO RIGHT—J. M. Joseph, Modern Electric Co.; Ralph Ramis, Stinson Electric Co., both from Jacksonville, Fla.; Howard McSpedon, Building & Construction Trades Council of Greater New York, C. A. Calame, Radio & Television Broadcast Engineers Union, Local 1212, IBEW, J. J. Kapp, Local No. 3, IBEW, all from New York City; J. D. Keenan, IBEW, Washington, D. C.; C. W. Moseley, R. H. Bouligny, Inc., Charlotte, N. C.; G. M. Freeman, IBEW, Washington, D. C.; S. C. Blumenthal, Sr. and Jr., Blumenthal-Kahn Electric Co., Inc., Baltimore, Md.

opments, and the part being played by electrical contractors in this work. He reported that 12 electrical contractors, working singly and collectively, have been carrying on Code work for the electrical contracting industry, and expressed a desire for participation by more contractors in the work of his Code panels.

LABOR

Gordon M. Freeman, recently elected International President of the IBEW, spoke of continued cooperation between the association and the brotherhood, urging united action in solving various difficulties which hamper operations of IBEW contractors. He particularly cited the problem of IBEW journeymen who frown on being assigned to house wiring work. According to Freeman, over 50% of all electrical work is being done by non-union workers. This he traced to the relinquishment of electrical repair, maintenance, servicing and house wiring to non-union contractors. IBEW contractors must be alert to avoid loss of this business, and both the union and the contractors have neglected this work. He believes the contractors must be competitively aggressive to get this work to maintain their position and to assure themselves of getting their share of such new markets as electronics and nuclear energy power generation.

William J. Cour, director of labor relations for NECA spoke of cooperation between NECA and the IBEW, according to definite principles:

1. Overlapping of the functions of various groups in the electrical industry is wasteful and should be eliminated in the interest of public service.

2. Close contact and a mutually sympathetic interest between employee and employer will develop a better working system and higher production.

3. Strikes and lock-outs are detrimental to the interests of employee, employer and the public and should be avoided.

4. Agreements designed to obstruct free development of trade or to secure special advantages to special groups are subversive of the public interest.

5. Public interest is served, hazard to life and property is reduced and work standards are improved by fixing an adequate minimum of qualifications in knowledge and experience as a requirement to the right of an individual to work in the electrical construction industry and by rigid inspection of electrical work, old and new.

6. Public welfare demands that electrical work be done by the electrical industry.

7. Cooperation between employee and employer acquires constructive power as both employees and employers become more completely organized.

8. The right of employees and employers in local groups to establish local wage scales and local working rules is recognized and must not be infringed upon.

In a talk on "Progress and Problems in Apprenticeship", Bill Damon, director of the Joint Apprenticeship and Training Program, called attention to expansion and development of the program. Mr. Damon emphasized that area committees are effectively meeting such local problems as control or the number of skilled workers made available. By careful programming labor force requirements can be met

L. E. Pennington, Valley Electrical Co., Westfield, Mass.; F. L. Lightfoot, Newport News, Va., and W. A. Collins, Collins Electric, Springfield, Mass.; R. E. Sell, Sell Electric Co., Mission, Kansas; A. E. Smiley, A. E. Smiley & Co., Inc., Kansas City, Mo.; H. R. Banyard, Enterprise Electric Co., Inc.; Morris Newmark, Morris Newmark & Bro.; W. H. Biester, Jr., Electro Construction Co., all from Philadelphia, Pa.

E. J. Weber, Weber Electric Co.; E. W. Peak, Central Electric Co., Inc., both from San Francisco, Calif.; C. L. Teal, Knight Electric, Birmingham, Ala.; E. R. Edenfield, Edenfield Electric, Nashville, Tenn.; A. Braunschweig, Brownie Industrial Electric Co., San Antonio, Texas; D. J. Duvoisin, Atlas Electric, New Orleans, La.; Rudy Viener, NECA, New Orleans, La.; J. M. H. Bayliss, Bayliss, & Ramey, Inc., South Charleston, W. Va.; L. E. Paul, Lawrence Electric Co., Wheeling, W. Va.

with due provision for supplying the needed number of trained men in years ahead.

Joseph D. Keenan, International Secretary of the IBEW, reported that the pension fund is not today actuarially sound. He said that analysis of the program by experts reveals a need for $4.50 per man per month going into the fund as of today to meet the $200,000,000 requirement by 1975. Until the input to the fund is substantially increased, the fund is not sound in the judgment of the actuaries. Mr. Keenan said the IBEW is asking more of its members to put the fund on a sound basis. This will come to $1 more per man per month for 1956 and $1.60 for 1957, he said. And this is being done by IBEW to relieve IBEW employers from an excessive burden of fund contributions.

Discussing expansion of markets and general increase in electrical work as an aid in promoting fund objectives, Mr. Keenan urged all electrical contractors to move into the vast residential market. He noted that out of a one billion dollar market in residential new construction only 25% of the work is going to IBEW contractors. This is a serious condition, he said, and more of the market should be actively sought by IBEW contractors.

OFFICERS

The last official act of the 1955 Convention was the presentation of Officers-Elect (to take office January 1, 1956) by Don B. Clayton. They are as follows:

Oliver F. Burnett, Jr., president of Kelso-Burnett Electric Co., Chicago—president of the National Electrical Contractors Association.

Charles W. Moseley, R. H. Bouligny, Inc., Charlotte, N. C.—vice president for line construction.

Carl L. Teal, Knight Electric Co., Birmingham, Ala.—District 3, vice president.

Alfred V. Bartlett, Sr., Rust Electric Co., Inc., Providence, R. I.—District 1, vice president.

Harold J. Hill, Hill Electric Co., Inc., Wichita, Kansas—District 5, vice president.

F. E. Keith, Keith Electric Construction Co., Des Moines, Ia.—District 7, vice president.

MC GRAW AWARD

Don B. Clayton, Sr., president of Electric Constructors, Inc., of Birmingham, and president of NECA from 1951 to 1956, was awarded the 1955 Contractors Medal and Purse, given under the James H. McGraw Award for Electrical Men. In the accompanying citation, Mr. Clayton was acclaimed for his efforts towards raising the level of management responsibility within the industry, bringing new recognition to the vital role of the contractor, and for his achievements in the difficult and challenging role of spokesman for his industry.

Louis Freund of New York City was also honored by the Award Committee, being cited with Honorable Mention for efforts related to the establishment and development of the vocational and apprenticeship training programs.

Harold A. Webster of New York made the presentations in behalf of the Committee of Awards. Judges consisted of E. L. Buttner, Oakland; E. C. Carlson, Youngstown; E. W. Frazer, Philadelphia, and R. W. McChesney, Washington.

EXPANDABLE SERVICE ENTRANCE consists of a 200-amp, flush-type, outdoor meter socket and a minimum 1½-in. conduit raceway from service cap to basement panel.

THE KEY TO

200-AMP Expandable Residential Wiring

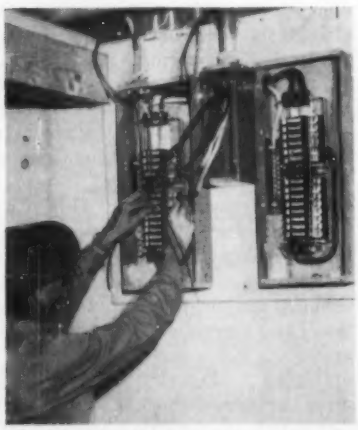
is Spokane's mandatory 1½-in. minimum service raceway. Industry-sponsored and city-enforced code rule breaks bottleneck to wiring adequacy and complete electrical living.

By August Eckel

SERVICE CONDUIT and meter panel are concealed in wall of house. Enlargement of service at a later date would involve expensive structural repairs also. New code rule precludes that.

INADEQUATE electric service capacity, the bottleneck to adequate home wiring, has been broken once and for all in the Inland Empire. On April 1, 1955, Spokane, Wash., reportedly became the first city in the United States to require a service entrance expandable to 200 amps on all homes over 500 sq ft in area. It is a city electrical code rule. Since that date more than 1000 new homes in Spokane are sporting 200-amp meter sockets and minimum 1½-in. conduit entrances. Service replacements on existing houses will have to meet similar standards. Increasing electrical capacity to meet future loads will be a relatively simple and inexpensive chore for these fortunate homeowners.

Up to this time few people, if any, in the industry were bold enough to take such a drastic step. There has been a general reluctance to legislate adequacy. The attitude has been, and undoubtedly will continue to be, that an electrical code is a minimum safety standard and not a design standard. The 1956 National Electrical Code will *recommend*, in a fine print note, that 100-amp, 3-wire services be installed in all homes. The National Association of Home Builders is *recommending* that its members supply 100-amp services in the homes they build. That may be as far as a national standard can go. But, local codes can be upgraded to fit local conditions.



WIRING TROUGH is terminus of service conduit in basement. Panel at left is for general circuits; that at right for electric heating. Without heating, space would be free for future panel and circuits.

CODE COMMITTEE drafts expandable service rule. Seated are: R. Anderson; D. G. Quinton, contractor; G. Bigger, electrical inspector; J. Reeves, electrical engineer; E. DeFeyter, contractor; H. Crumbaker, inspector; R. Crosby, WWP Co.; M. Johnson. Standing: Chief electrical inspector, J. Paxton (at backboard); A. Wilson; C. Hoffman and G. DeFoe, WWP Company.

The Spokane Problem

Local conditions were the basis for the change in the Spokane City Electrical Code. Here is the problem the electrical industry faced:

1. The existing code called for a standard 60-amp service.

2. In 1954, average annual residential kilowatthour consumption was approximately 7,000—almost three times the national average of about 2,400 kwhrs. Average cost per residential kilowatthour was 1.27 cents against a national average of 2.7 cents.

3. Electrical dealers in the Spokane area reported an estimated $200,000 lost sales in 1954 because of inadequate home wiring.

4. Some 600 homes required remodeled services in 1954, at an average cost of $125, before an electric dryer could be installed.

5. Three appliances alone—range, quick recovery water heater and high wattage (fast drying) clothes dryer —add 92 amps of diversified load to the wiring system.

6. A substantial shift to primary electric heating (complete space heating) in new and old homes has taken place.

7. During the spring and summer of 1955, some 1000 new homes were being built within Spokane city limits. Based on past experience, the services on many of these houses would have to be replaced within a year unless something were done quickly.

Expandable Wiring the Answer

That was Spokane's home wiring dilemma at the beginning of the year. To solve the many problems it presented, the local electrical industry followed a realistic approach. Inadequate service capacity was the one roadblock to a homeowner's full enjoyment of all the electrical appliances available. It was the key to any future home wiring expansion. Break this bottleneck with a service big enough to take known loads and provide for future additions and half the battle of Adequate Wiring would be won. Thus, efforts were concentrated on developing a reasonable service entrance requirement.

Spokane's electrical code was due for an overhaul anyway. The one question was whether to base its revision on a 100-amp service or larger. Subsequent analyses of electrical loads in an average Spokane home of 1,000 sq ft area showed the futility of using the 100-amp yardstick. Such a home with conventional appliances (range, dryer, water heater, dishwasher,

THE FOUR STEPS TO SPOKANE'S EXPANDABLE ELECTRICAL LIVING

STEP I — BASE SERVICE ENTRANCE ON ENGINEERING FACTS AND EXPERIENCE.

Load calculations for 1,000 sq ft home with normal appliances

Study 1 With normal appliances			Study 2 Add quick recovery water heater plus 2 spare appliance circuits***	
Diversified Watts	Actual Watts	Circuits	Actual Watts	Diversified Watts
	3,000	Lighting (3 w/sq ft)	3,000	
	1,500	(1) Appliance	(3) 4,500	
	4,500		7,500	4,575*
8,000**	12,000	Range	12,000	8,000**
4,750	4,750	Dryer	4,750	4,750
	3,000	Water Heater	4,500	4,500
	1,100	Dishwasher	1,100	
	700	Furnace	700	
	1,500	Bath Heater	1,500	
	350	Freezer'	3,300	
	1,000	Laundry'	at 75%	2,475
	7,650			24,300
5,740	at 75%			106 Amps
22,015				
96 Amps				

Notes: * — First 3,000 watts at 100%, remainder at 35% diversity.
** — Diversified range load at 66⅔% of rated load.
*** — New code rule requires two spare appliance circuits.
' — Freezer and laundry connected to new appliance circuits in Study 2.

STEP II — MAKE MANDATORY INDUSTRY-SUPPORTED MINIMUM SERVICE DESIGN STANDARD.

Support of electrical industry, home builders, architects, engineers, and financing agencies led to City Council approval of Spokane's new electrical code regulation:

Section 36-C-3 "Residential service entrance conductors may be installed in one of two methods, as follows: For new buildings, for single family occupancy, for areas over 500 square feet, service entrance conductors shall be installed in a raceway of 1½-in. minimum, rigid or electrical metallic tubing, to comply with Section 35-C, using an approved 200 amp meter socket, said raceway to terminate in a suitable cabinet or gutter. For re-wiring, or for areas of less than 500 square feet, other than in fire zones No. 1 and No. 2, the method may be as above, or with a service entrance cable, provided it is installed as exposed wiring on the exterior of the building, in accordance with the National Electrical Code, passing only through the building wall to the distribution center. Parallel runs of cable will not be allowed."

STEP III — CERTIFY EXPANDABLE WIRING AT SERVICE INSTALLATION.

Double-Seal certification in Spokane provides the homeowner with the top half of a Seal certifying that the service entrance meets Expandable Wiring requirements and can be easily increased in capacity to meet future load demands up to 195 amps.

STEP IV — ADD A-W SEAL WHEN REQUIREMENTS ARE MET.

If, and when, the circuiting, switching and number of outlets in the home meet minimum certification requirements of the Inland Empire Adequate Wiring Bureau, the bottom half of the split-seal is added. Possession of the Double-Seal denotes the home is equipped with an Expandable Adequate Wiring System.

furnace, freezer, bath heater, laundry, one appliance circuit and three watts per sq ft for lighting would have a diversified load of 96 amps. Add two spare appliance circuits (now in the new code) to take care of the laundry and freezer as well as future appliances, plus a quick recovery water heater, and the diversified load would be approximately 106 amps. Should a home have a range, quick-recovery water heater and high wattage (fast drying) clothes dryer, 92 amps of diversified load would already be used up.

The obvious solution was provision, at a minimum addition in initial cost, for a service entrance that could be easily expanded at some future date from 95-amp to 195-amp loading without disturbing the installed raceway. This was an important consideration, since Spokane practice is to use outdoor flush meter sockets with service conduits concealed in the building wall.

Careful analyses of all code allowances and a study of conduit fill rules led to a choice of 1½-in. conduit as the *minimum* size service raceway, with a 200-amp, heavy-duty meter socket, terminating in a suitable interior panel or gutter. This design, which became a code rule, is the keystone of the Spokane Expandable Wiring plan, a program designed to protect the homeowner against expensive electrical system expansion at some future date. A cooperative manufacturer supplied the heavy duty meter sockets at a reasonable cost and the program was under way.

Installation of the expandable service does not mean that 195-amp service cables must be installed at the same time. These can be pulled in when the diversified load in the home warrants heavier cables. However, the Washington Water Power Company, and the electrical industry, do recommend initial installation of No. 1 RH (130-amp) cables to provide a substantial measure of reserve capacity in the average home. Any future electrical remodeling can take place at or beyond the service panel without disturbing the building walls. This will be considerably less expensive than replacing the service entrance.

How It Was Sold

It is not easy to sell better home wiring to builders—especially those engaged in tract-type projects. It took more than a decade of promotion and education on the part of the National Adequate Wiring Bureau to reach today's plateau of acceptance. It is even more difficult to legislate electrical adequacy in the form of code requirements. There exists a reluctance to "force" better wiring on the public —to cross that intangible line between safety and design standards in an enforceable code. Spokane did it in a most realistic manner.

Since the situation in Spokane was more or less critical, a public educational program with its long range implications was ruled out. Instead, all concerned were brought together to face the problem and devise a satisfactory solution. Through the efforts of Gordon DeFoe, general sales supervisor, Washington Water Power Company and James Paxton, chief electrical inspector, City of Spokane, a Wiring Standards Committee was formed. On it were representatives of the National Electrical Contractors Association, American Institute of Architects, FHA, Home Builders Association, Washington Water Power Company, Inland Empire Electrical League, city electrical inspector, consulting engineers, electrical distributors, and building and loan associations. They were presented with the wiring problem and the "expandable service entrance" solution.

Basis of argument for an electrical code rule was that structural codes contained a "design factor of safety" which took care of future loads. No one has to add more floor joists when more furniture is brought into the home, or more than the original two or three people are in the house. Why shouldn't an electrical code do the same?

After thorough study, Wiring Standards Committee members decided it should, and letters endorsing the expandable service entrance plan were obtained from all concerned.

Newspaper ads and supplementary editorial publicity explained the problem and solution to the general public so they could understand and appreciate what was being done.

A Code Committee drafted the necessary revision to the City Electrical Code. The revision, backed by the written endorsement of the organizations and individuals on the Wiring Standards Committee, was passed by the City Council and the Expandable Service Entrance became law.

Nor is such a code rule confined to the City of Spokane. Already five cities around Spokane, each with its own electrical inspection, have the mandatory 1½-in. service conduit and 200-amp meter socket. Other cities are interested in the plan.

Double-Seal Certification

Any certification problems which may arise from the mandatory expandable service entrance and the voluntary adequate wiring standards have been solved by a unique "Double-Seal" program operated by the Washington Water Power Co., and the Inland Empire Adequate Wiring Bureau. Homes with the "200-amp" service raceway get the upper half of a split-seal (bearing the WWP imprint) certifying they are equipped for "Expandable Wiring". If, and when, these homes meet the circuiting, switching and outlet requirements of the AW Bureau, the bottom half of the seal is added. This bears the imprint of the Inland Empire AW Bureau and certifies the home is adequately wired.

Residential wiring promotion in Spokane now operates on the premise that modern adequate wiring starts with the "Expandable" service entrance; that the home buyer who insists on the "Double Seal" automatically insures his family against inconvenience, obsolescence and unnecessary wiring expense for years.

WIRING STANDARDS COMMITTEE endorsed Expandable Service Entrance design. Seated: C. Martell, president, Spokane AIA; L. Stewart, president, NECA Chapter; J. Paxton, chief electrical inspector; D. G. Quinton, committee chairman; A. Eberle, president, Spokane Home Builders Assn.; J. Dullanty, Fidelity Savings & Loan; H. Bolin, director, Spokane FHA; C. Tubbs, electrical distributor. Standing: G. DeFoe, WWP Co.; H. Vincent, president and F. Tool, manager, Inland Empire Electrical League.

Conducting Labor Cost Studies—II

A discussion of break-down studies as the basis of accurate labor unit development and the establishment of true labor cost distribution.

By Ray Ashley

Research and Consulting Engineer

Oak Park, Illinois

BREAK-DOWN Studies have been previously defined as being "studies of all labor occasioned by a particular piece of equipment or material." *To obtain accurate labor cost units, labor must be charged to the item occasioning it and not necessarily to the item on which it is performed.* True distribution of costs can only be established when the break-down labor for individual items is studied and analyzed. The difficulties encountered and the accuracy of results depend on many things—such as materials, working conditions and methods of keeping records.

A break-down study of outlet boxes was included in the previous article (Part I, EC&M, Nov., 1955, pg. 87). The type of job and nature of the installation, on which this study was conducted, was such that the work chargeable to outlet boxes could be segregated from other operations with a fair degree of accuracy. In contrast, Fig. 1 shows a study of rigid conduit elbow installation time. Here, many of the operations, such as material distribution, setting up tools, and planning cannot be separated easily from those belonging to the conduit installation. In addition, there is study time and ordering time that overlap. Note, however, that both studies include cutting and threading time for the conduit to which the box or elbow was mounted. Although the work was performed on the conduit, the labor was charged to the item occasioning it (box or elbow). If there were no box or elbow in the run, there would be no need for two cuts and two threads on the conduit.

One must not be too optimistic about the consistency of results to be obtained from time and motion studies. Usually they are wide and varied and one has to piece together the findings of several studies before a logical picture can be created. Analysis of individual items seldom reflect all the incidental labor. The findings must

TIME STUDY FOR ELBOWS
Rigid Conduit, 12-ft. Ceiling, Machine Cutting and Threading

DIVISION OF LABOR / Elbow Size	TIME IN HOURS 1½"	2"	2½"	3"
Study Time — Ordering and Checking	.06	.08	.10	.10
Unloading and Delivery to Storage	.05	.07	.09	.12
Distribution from Storage to Work Area	.06	.10	.12	.15
Measuring for Elbow Installation	.20	.22	.25	.25
Cutting and Threading Conduit	.30	.45	.60	.75
Installation	.30	.50	.85	1.00
TOTALS	.97	1.42	2.01	2.37

Note: The weight of the elbow affects only the installation and handling time.

FIG. 1—LABOR UNITS for elbows includes all time-study operations involved in installation. Cutting and threading of conduit plus incidental labor caused by elbow insertion should be charged to the elbow.

EXAMPLE NO. 1

100 Boxes, 1,200 ft. Conduit

Material	Quantity	WRONG Labor Unit	WRONG Labor Ext.	CORRECT Labor Unit	CORRECT Labor Ext.
Ceiling Outlet Boxes	100	.50	50	.85	85
½" Rigid Conduit	1,200'	.10	120	.05	60
No. 14, Type R Wire	3,000'	8.0/M	24	6.0/M	18
Inserts	200			.18	36
	Total Manhours		194.0		199.0

EXAMPLE NO. 2

25 Boxes, 1,200 ft. Conduit

Material	Quantity	WRONG Labor Unit	WRONG Labor Ext.	CORRECT Labor Unit	CORRECT Labor Ext.
Ceiling Outlet Boxes	25	.50	12.5	.85	21.25
½" Rigid Conduit	1,200'	.10	120	.05	60
No. 14 Type R Wire	3,000'	8.0/M	24	6.0/M	18
Inserts	200			.18	36
	Total Manhours		156.5		135.25

CONDUIT INSTALLATION – RIGID STEEL

Ⓝ Approximate Distribution of Labor for Feeder Conduit
Fastenings and Hangers not Included

SIZE	1/2"		3/4"		1"		1-1/4"		1-1/2"		2"		2-1/2"		3"		3-1/2"		4"	
WEIGHT – 100FT	85		113		168		228		273		368		582		762		920		1089	
	DIVISION OF TIME – HRS. PER 100FT. AND PERCENTAGES																			
	Hrs.	%	Hrs.	%	Hrs.	%	Hrs.	%	Hrs.	%	Hrs.	%	Hrs.	%	Hrs.	%	Hrs.	%	Hrs.	%
Study time, ordering and checking	.20	5.	.22	4.4	.30	4.3	.35	4.0	.40	3.6	.45	3.0	.45	2.1	.45	1.8	.50	1.7	.60	1.5
Unload and deliver to storage space	.08	2.	.10	2.	.18	2.6	.30	3.4	.40	3.6	.30	3.3	.80	3.8	.90	3.6	1.10	3.7	1.40	3.5
Moving from storage to point of installation	.08	2.	.10	2.	.18	2.6	.30	3.4	.40	3.6	.30	3.3	.80	3.8	.90	3.6	1.10	3.7	1.40	3.5
Laying out runs and measures for nipples	.75	18.7	.80	16.	.80	11.4	.80	9.1	.90	8.2	1.00	6.7	1.10	5.2	1.10	4.4	1.20	4.0	1.50	3.7
Setting up and handling tools	.10	2.5	.10	2.	.14	2.	.30	3.4	.30	2.7	.40	2.7	1.00	4.8	1.00	4.0	1.25	4.2	1.50	3.7
Cutting conduit – Includes measuring. 3 cuts per 100 ft.	.20	5.0	.23	4.6	.60	8.6	.70	8.	.80	7.3	1.20	8.0	1.80	8.6	2.25	9.0	2.70	9.0	3.50	8.7
Threading – Includes necessary cleaning. 5 threads per 100 ft.	.75	18.7	1.00	20.	1.50	21.4	1.95	22.2	2.40	21.8	3.50	23.3	5.20	24.8	6.60	26.4	8.00	26.6	10.75	27.0
Installing conduit (Not including El's and offsets)	1.00	25.0	1.25	25.0	1.55	22.	2.00	22.6	2.50	22.8	3.50	23.3	4.70	22.4	5.70	22.8	6.75	22.3	9.00	22.5
Install El's and couplings 2 per 100 ft.	.35	8.8	.50	10.	.60	8.6	.70	8.0	.80	7.3	1.25	8.4	1.60	7.6	2.00	8.0	2.50	8.3	3.25	8.1
Offsets – Making and installing	.34	8.5	.50	10.	.90	12.9	1.10	12.5	1.75	15.9	2.25	15.	3.00	14.3	3.50	14.0	4.20	14.0	6.00	15.0
Connections at panel board or cabinets – 2 per 100 ft.	.15	3.8	.20	4.	.25	3.6	.30	3.4	.35	3.2	.45	3.0	.55	2.6	.60	2.4	.70	2.3	1.10	2.8
Totals	4.00	100.	5.00	100.	7.00	100.	8.80	100.	11.00	100.	15.00	100.	21.00	100.	25.00	100.	30.00	100.	40.00	100.

Ⓝ – Costs vary according to job conditions and methods of handling work

FIG. 2—CONDUIT TIME-STUDY provides a versatile estimating tool. Break-down units for individual operations can be used for adjusting labor to suit special conditions or for development of new units for special or new equipment.

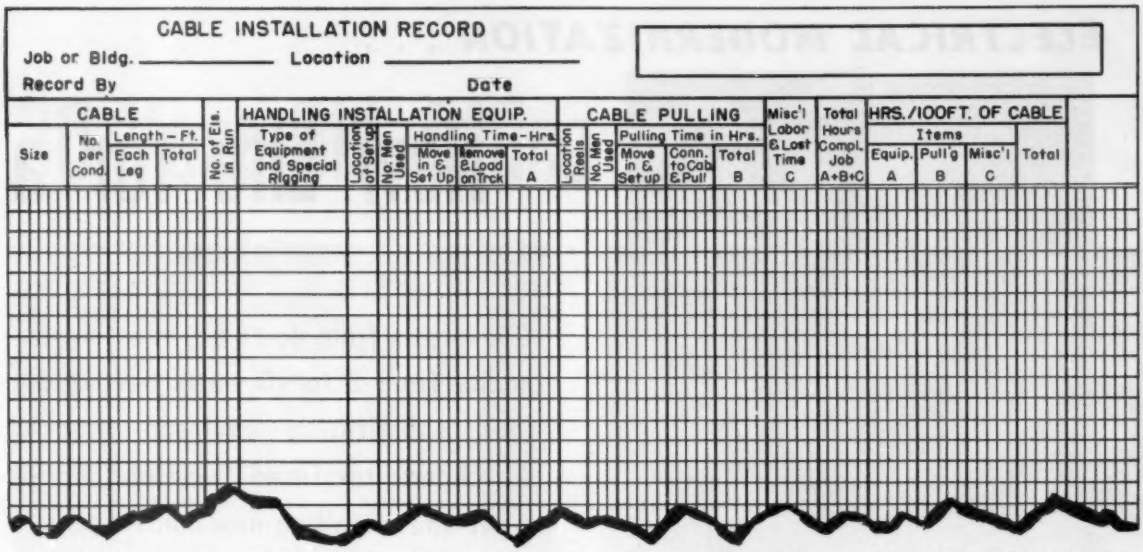


FIG. 3—SPECIAL FORMS facilitate time-study work. This cable installation record, with break-down columns for each operation involved plus recap columns for operational totals, gives a complete labor cost picture.

be checked by supplemental job division studies.

Making the Study

To successfully conduct a break-down labor study, the work must be the sole chore of an individual. The assignment should not be given to a foreman to carry on with his regular duties. Occasionally, a single study will produce good, reliable figures. However, it usually requires several studies of a single operational item before a satisfactory value can be developed and used as a standard labor unit.

Although the units for outlet boxes were developed on a single installation, the number of floors on the project produced the equivalent of several jobs and the work was in the hands of an exceptionally good man. The units for conduit elbows (Fig. 1) represents a combination of several studies with more or less assumed figures for study-time and ordering time. Prorata handling time was approximated as well. The units represent a fairly accurate segregation of time for measuring, cutting, threading and installation.

Unit totals for 1½-in. and 2-in. elbows in Fig. 1 are higher than those usually found in labor unit tables. It has always been my contention that the tendency has been to underestimate the cost of installing elbows. Interrupting conduit installations to add elbows takes a labor toll that is not reflected in time studies.

The distribution of labor breakdown for rigid conduit installation shown in Fig. 2 is the result of numerous studies conducted by a number of different electrical contractors. However, conditions under which each study was made were similar. Installations were large, working conditions favorable, mechanics first class and manpower support good. Because of this, total labor costs are lower than those found on many jobs.

Study of this chart (taken from page 50, "Electrical Estimating", First Edition, McGraw-Hill Book Company) will provide a liberal education in conduit installation. The labor distribution listings and figures are very flexible tools for adjusting conduit labor units to suit special conditions. Only the labor for that specific portion of the work affected by the special condition need be changed to secure the necessary adjustment.

Comprehension Needed

The value of time-study data is dependent, to a large degree, upon the understanding of the person conducting the research. He must know what he is looking for and how to correlate and use the data once he has compiled it. A natural inquisitiveness and propensity for ferreting out labor costs is a prime asset. Unless the researcher, estimator or contractor possesses some of these qualities, he will have trouble with his own time-study data and will gain little from that prepared by others.

Throughout the years, the electrical construction industry, generally speaking, has gained many benefits from time-study activities. Proper allotment of labor heads the list. Before careful time-studies were conducted, there was a general tendency to assign too much labor to conduit work and not enough to outlet box installation. This was a natural hangover from the days before labor units were used. Contractors figured the cost of material, then took a percentage of that cost for labor. When they tried to establish units, they would prorate labor according to material costs.

With the development of accurate labor units, based on actual installation experience (time-study), and the increased complexity of electrical systems came the present accepted practice of estimating and pricing labor according to the work involved. Even under this system, application of the "proper" units is important.

The need for studying layout and the effects of incorrect pricing of labor is illustrated in the following examples. Example 1 shows that as long as a 12-ft. spacing of outlet boxes was maintained, either the "wrong" or "correct" units would give approximately the correct price. In Example 2, with a wider spacing (48 ft) between outlets the "wrong" units produce an estimate that is too high. Had the spacing been less than 12 ft, the estimate would have been too low.

Compilation of labor units on a break-down or time-study basis is a first step in making a labor cost study. However, before usable standard units are developed, the break-down ones should be checked on a broader scale. This is usually done on a Job Division basis—a subject to be explored in the next article of this series.

ELECTRICAL MODERNIZATION . . .

CONVERSION FROM DC TO AC and multiplying capacity of 30-year-old building five times involved installation of four 4000-amp dead-front channel-mounted switching centers, each served by separate low-reactance ventilated busduct feeder from utility vault.

New Life for a

Conversion from dc to ac, boosting capacity from 2 to 10 watts per square foot, substituting enclosed breaker switchgear for fused live-front equipment and installing new control panels gave 30-year-old Cleveland office building a new lease on life. Completed job reveals numerous practical installation methods developed by Herbst Electric Company.

BACK in the '20s when the 16-floor Hanna Building first dented the skyline of Cleveland, Ohio, tenants were impressed with this modern office structure providing 2 watts of dc for each of its 400,000 ft. But times have changed; and the then-approved capacity of 2w/sf has long-since shackled Hanna's management, making it either difficult or impossible to heed tenants' wishes for better lighting, air conditioning, motorized office equipment or similar today-commonplace requisities for modern offices.

Attempting to keep pace with progress, a small auxiliary ac service was installed. This made it possible to provide a limited amount of fluorescent lighting and air conditioning for lower-floor premises. In addition, the loading of the dc system had been pushed close to its safe limit, but this capacity boost had incurred the expected penalties of lowered voltage with corresponding decreases in illumination levels and motor efficiencies.

This past year, therefore, the T. W. Grogan Company, managers, decided to shun further half-way compromises and to go all-out for a ground-to-penthouse electrical revamping.

This was no minor operation, for it involved a comprehensive conversion from dc to ac, plus the installation of four additional transformers, one power and two lighting distribution centers, 36 new feeders involving 10 miles of 500MCM cable, considerable low reactance busduct, and specially-designed bottom-access cable troughs. This resulted in jumping the building's capacity to 10 watts per sq ft of floor area.

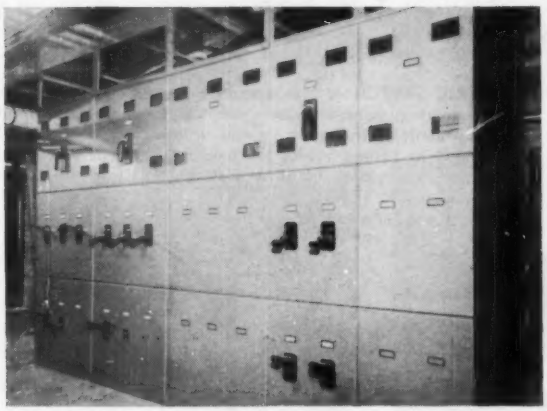
Throughout this transition, the main problem was one of feeder routing, for (1) bearing walls were thick and numerous, (2) floor plans were irregular, with few walls or corridors at right angles, (3) headroom in the basement was limited, with already-installed steam and water pipes reducing clearances to 5 ft 9 in. in several locations, (4) existing riser shafts were not sufficiently large to accept all of the new feeders, (5) shafts did not extend continuously from basement to roof, (6) cable reels could not be carried into upper-floor corridors due to the possibility of marring marble surfaces, and (7) basement floors and ceiling sections involved frequent changes in elevation.

Complications related to initial routing can be better-appreciated by glancing at the accompanying partial-basement plan, for this sketch shows the widely-separated locations of service tap boxes, old and new distribution boards, plus bases of three principal feeder risers. It also shows the number and direction of intervening bearing walls and structural columns, and indicates the approximate positioning of low-reactance ventilated feeder busduct (between tap boxes and ac distribution boards), bottom-access cable troughs (between distribution boards and bases of riser shafts), and overhead racks (between the old dc board and the larger of the two new ac lighting distribution centers).

Another indication of routing complications can be obtained from the isometric sketch showing the numerous horizontal and vertical offsets in the low-reactance ventilated busduct installations that extend between service tap boxes and the various distribution centers. These offsets were made necessary by differences in basement ceiling levels, the existence of intervening walls (not indicated in the sketch for the sake of simplification and clarity), and a maze of piping related to other trades, services and utilities.

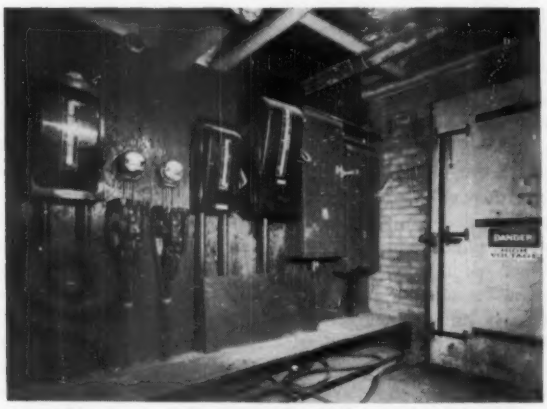
Even with that notation, the sketch still does not tell the full story; for corridor ceilings were low and already covered with pipes for other utility services. Therefore, if conventional

30-Year-Old Office Building



INSTALLATION VIEW shows partial assembly of main 120/240-volt lighting control center containing series of 300-amp breakers. Overhead pullbox and cable racks permit feeders to be shifted from old dc board as modernization and ac conversion progresses.

OLD LIVE-FRONT SWITCHBOARD still stands in its original entirety, although it now has only limited use serving the dwindling amount of dc equipment remaining in the building. Prior to modernization program, overloaded circuits created low voltage, motor inefficiencies and curtailed lamp outputs.



2 WATTS PER SQUARE FOOT was original capacity of 10-acre floor area served through this now-obsolete incoming-service panel. While adequate for office demands of the '20s, this bottleneck prevented installation of present-day conveniences in 30-year-old structure.

GROUP OF NEW AC TRANSFORMERS provided power for four 4000-amp busduct feeders extending through bearing walls and along basement ceiling to distribution and switching centers. Connections between transformers and bus taps are via two 500MCM AVA cables per leg.

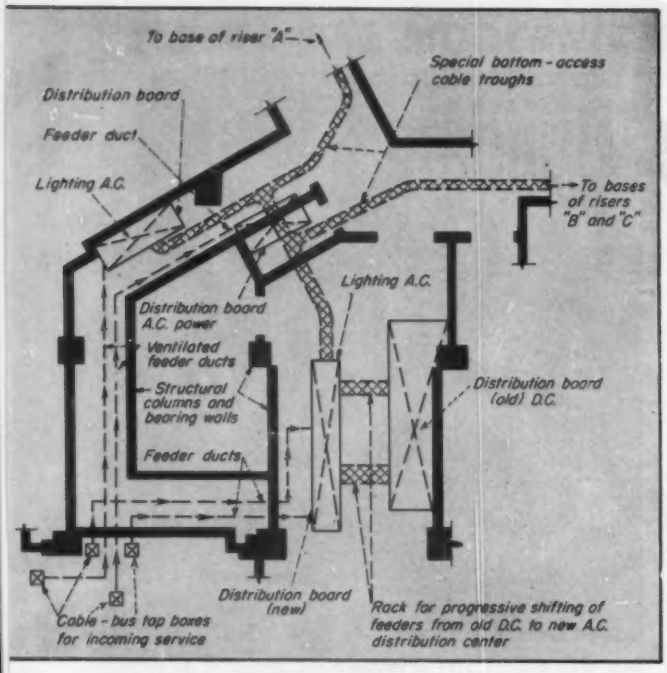
top-access cable troughs or racks had been placed beneath these pipes, headroom would have been further reduced, while access to these other services would have been blocked permanently.

Initial routing plans were therefore revised; shifting busducts and feeder cables from corridors into adjacent service spaces in several instances, and utilizing a special bottom-access (rather than top-access) cable trough to contain horizontal feeder runs.

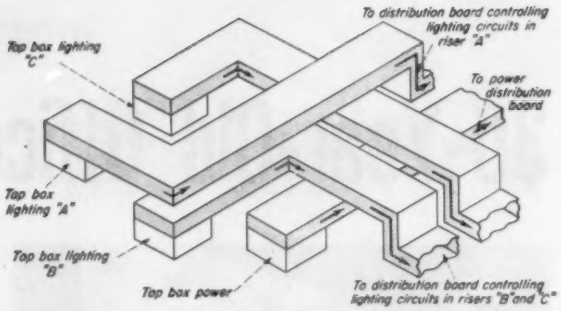
Shifting feeders from corridors to service areas involved the piercing of more bearing walls and slight increases in overall feeder lengths, yet it simultaneously prevented electrical work from blocking other services, and it resulted in greater headroom, improved working conditions and more freedom of movement.

Headroom was likewise increased through the use of bottom-access troughs, for these special troughs were sufficiently wide to hold all cables side by side in a single tier; the overall depth of the trough was only 7 in., and troughs could be secured flush against ceiling slabs where necessary for maximum clearance.

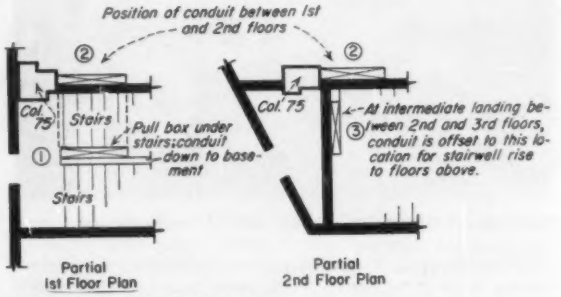
These troughs—specially designed


To base of riser "A"
Special bottom-access cable troughs
Distribution board
Feeder duct
Lighting A.C.
To bases of risers "B" and "C"
Lighting A.C.
Distribution board A.C. power
Ventilated feeder ducts
Structural columns and bearing walls
Distribution board (old) D.C.
Feeder ducts
Distribution board (new)
Rack for progressive shifting of feeders from old D.C. to new A.C. distribution center
Cable-bus tap boxes for incoming service

PARTIAL BASEMENT PLAN indicates complicated routing of feeder busducts and cable troughs between widely-separated substation vault, tap boxes, power and lighting distribution boards, old dc switchboard and riser shafts. Note number and irregularity of intervening bearing walls. Availability of enough floor space to mount new boards without removing old equipment permitted continuation of service during all stages of modernization program in this building.


To distribution board controlling lighting circuits in riser "A"
Tap box lighting "C"
To power distribution board
Tap box lighting "A"
Tap box lighting "B"
Tap box power
To distribution board controlling lighting circuits in risers "B" and "C"

ISOMETRIC SKETCH of low-reactance ventilated feeder busducts, extending between substation tap-boxes and scattered switching centers, indicates jig-saw interlacing necessitated by changes in ceiling elevation, existing bearing walls and maze of piping related to other services and trades.


Position of conduit between 1st and 2nd floors
Col. 75
Stairs
Pull box under stairs; conduit down to basement
Stairs
At intermediate landing between 2nd and 3rd floors, conduit is offset to this location for stairwell rise to floors above.
Partial 1st Floor Plan
Partial 2nd Floor Plan

NEW FEEDERS WERE CARRIED UPWARDS along walls of stairwells, although unsymmetrical structural plans of lower floors necessitated offsetting of conduits and pullboxes, as indicated by positions 1, 2 and 3 in this first-to-second floor routing of a central riser.

by the electrical contractor on the job—consisted essentially of sheet steel tops and flanged sides, removable bottom panels, and transverse steel rods on 3-ft centers to support cables carried within the enclosures. Rods were loosely sheathed with fiber tubing to facilitate cable pulling and protect cable insulation, while rods were threaded at both ends and capped with standard conduit bushings to prevent them slipping from mounting holes drilled in trough side sections. Ventilation for the enclosures was obtained by closely spacing 4-in. circular holes in all side sections, with expanded-metal mesh serving as safety screening over these openings. Suspension of troughs from ceiling slabs or beams was by means of flat steel straps bolted to troughs, with expansion anchors or clamps securing the upper ends.

Another practical installation solution—also devised by the electrical contractor—concerned the vertical routing of feeders to upper floors. This departure from normal procedure was dictated by the fact that cross-sections of existing riser shafts were limited in area, thereby making it impossible to carry all new risers upwards via those intended routes. Fortunately, however, all of the shafts were situated next to stairwells, separated from them only by bearing walls. Therefore new risers were extended upwards along either or both sides of these common walls, with pull boxes, horizontal nipples and offsets connecting risers with floor taps, control panels and switches.

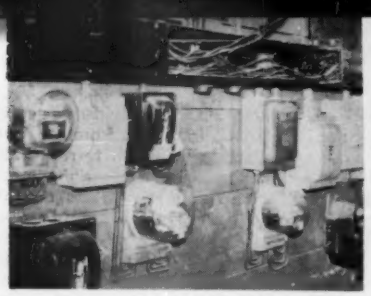
Where it was necessary to carry vertical conduit risers through stairway landings, holes were drilled by a mobile electric machine equipped with soft-steel cutting tubes and using carbide-dust abrasives. Rate of cutting through concrete was approximately an inch a minute; a 4-in. hole in an 8-in. slab requiring about 10 minutes to complete.

This method proved to be both fast and silent. Holes were neat and clean. Concrete cores were removed whole, with negligible dust or crumbling. The quiet operation of the drill permitted work to be carried on in regular working hours without disturbing tenants in nearby offices. And resultant savings in time (compared to conventional methods using hand tools) more than paid for the $600 drilling rig on this single job.

One further routing problem involved the linking of horizontal basement feeders with these newly-installed vertical risers, because first and second floor plans were not symmetrical, thereby necessitating additional offsetting of conduits and pullboxes.

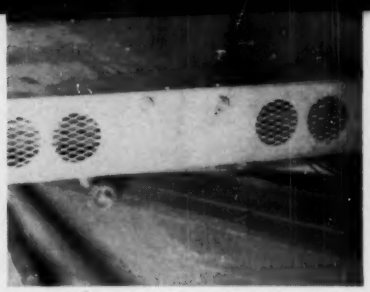
For example, one series of conduits was installed from a basement pullbox to a second pullbox located beneath stairs descending from a first-floor stairwell landing. Conduits were then shifted laterally through the stairwell wall and carried up to the second floor, where they were again offset back into the stairwell, rearranged in a line at right angles to their initial grouping, then carried up to the 16th floor through sleeves drilled through successive stairway landings as previously described. Conduits were supported at each landing by means of sectional collar clamps positioned above landing slabs, while cables were supported within conduits by split-wedges at each pullbox.

Counting old as well as new panels, the building now has over 200 upper-floor enclosures; 52 of which (about a fourth) are still used as dc distribu-

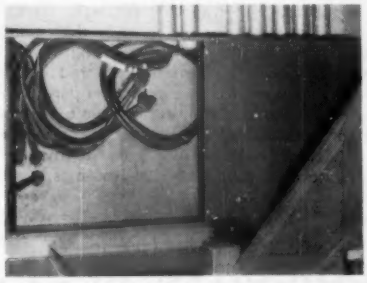


LOWER-FLOOR AC REQUIREMENTS for air conditioning and fluorescent lighting had been partially met during last few years by introduction of small auxiliary utility service and switching center. This however, was makeshift arrangement pending complete conversion.

MAZE OF PIPES related to steam and water supply completely covered ceilings of low-clearance basement corridors. Therefore electrical feeder troughs were carried through walls into adjoining service areas so that access to these other services would not be restricted.

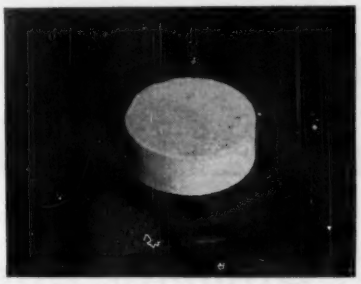


CONTRACTOR-DESIGNED CABLE TROUGHS consisted of sheet-steel enclosures, with removable bottom panels bolted to side-section flanges. Screened vent holes provided for ventilation, and transverse fiber-sleeved bushing-capped rods were installed to support cables.



VERTICAL FEEDERS were carried upwards along either or both sides of walls separating limited-area riser shafts from adjacent stairwells, with pullboxes and offsets connecting risers with local control panels and motor switches. Split-wedge supports hold cables within conduits.

PASSAGE OF CONDUITS THROUGH LANDINGS of stairwells was through holes drilled with portable electric rig using soft-steel cutting head and carbide-dust abrasive. Rate of cutting was approximately an inch per minute for 4-in. diameter hole; an 8-in. slab requiring about 10 minutes to penetrate.



CONCRETE CORE removed by electric hole-cutting rig remained in single piece, with negligible crumbling or dust. Quiet operation of rig permitted drilling to be carried on in regular working hours, while resultant savings in time more than paid for the cost of this practical electric tool.

tion or control cabinets. Another 58 serve as pullboxes, while the remaining hundred are related to the new ac distribution system.

In the main building (this does not include an annex), there now are also 45 feeders; 10 supplying 3-phase 3-wire 240-volt power, and 35 supplying single-phase 120/240-volt 3-wire service for lighting and small appliances. Feeders consist essentially of three 500MCMs, pulled upwards through 3-in. conduits by power winches positioned at upper-floor boxes. Feeder breakers are set to trip at 300 amps and, of the 120/240-volt feeders, 15 originate at each of three switching centers.

These three centers (2 of which are combined in one large common cubicle assembly), plus the separate power distribution panel in the basement, are all dead-front channel-mounted free-standing units, with main switches fused for 4000 amps. Centers are powered through four separate low-reactance ventilated 3-pole full-neutral busducts extended from tap boxes in the substation vault, while tap boxes in turn are connected to utility transformers via two 500MCM AVA cables per leg.

Due to the facts that drilling operations were unusually quiet, cable reels were kept out of upper-floor corridors, risers were installed in or adjacent to stairwells, and sufficient basement space was available for the installation of new ac switchboards without interfering with old dc equipment, the majority of the work could be carried on during normal working hours without disturbing tenants or interrupting electrical service.

This resulted in a smooth transition from dc to ac; it multiplied the former electrical capacity of the building five times (from 2 to 10 w/sf); it reflected sound planning and design by consulting engineer William B. Furguson, and it paid tribute to the craftsmanship of the Herbst Electric Company.

Even before the job was completed, tenants started to tap this new electrical life-stream. For example, one tenant promptly installed a fluorescent lighting system that boosted footcandles from 15 to 65. The result is a more efficient, safe and modern structure.

FLUORESCENT LIGHTING, air conditioning and 3-phase office machines began making their appearance in the Hanna Building even before the dc-ac conversion and service expansion program was completed. Benefits resulting from this comprehensive electrical modernization won instant commendation from tenants.

GENERAL LIGHTING in the main lobby is provided by carefully positioned recessed downlights. In the background, five 500-watt downlights are evenly spaced from left to right (the entrance to the lobby is just out of sight in the right background) to provide 10-foot-diameter round patterns on the floor. These patterns are lined up close to the wall and are in line with the entrance. In the foreground, 300-watt downlights are evenly spaced to provide uniform light patterns in the area. Each unit provides an even light throw with less than 5% variation in intensity between the center and outer edge of the round pattern. The design objective here was to provide enough light for a variety of activities by achieving high and low light intensities in a manner which would highlight furnishings and in a pattern which would add an artistic touch of its own. And effective concealment of light sources affords maximum visual comfort. Special lighting techniques shown in this photo involve lighting of the life-size oil painting on the far wall and lighting of mosaics around fireplace at left background. A special 300-watt, lensed projector is concealed in the ceiling about 5 feet from the far wall, directly in front of the picture. Through a ½-inch hole in the ceiling, this projector throws a uniform concentration of light which sharply and exactly illuminates the rectangular area of the picture, with no light spillover anywhere around the perimeter. This technique brings the picture to life and creates a striking appearance against the subdued wall paneling. Three similar projector units are concealed in the ceiling close to the fireplace, lighting the precise area covered by the mosaics.

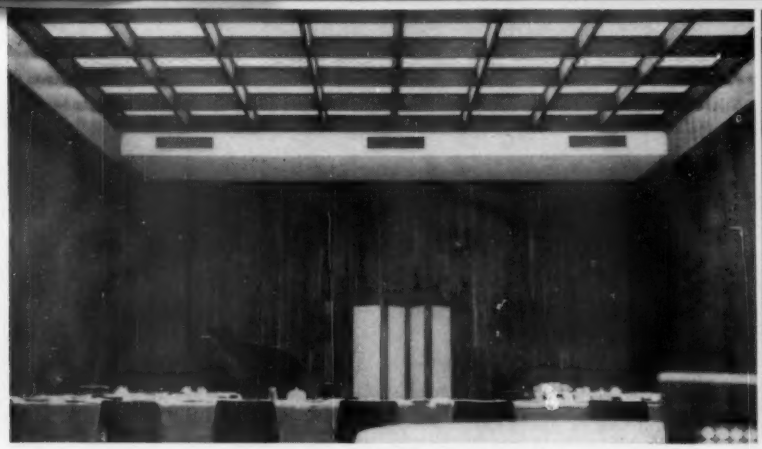
Dramatic effect was primary objective in . . .

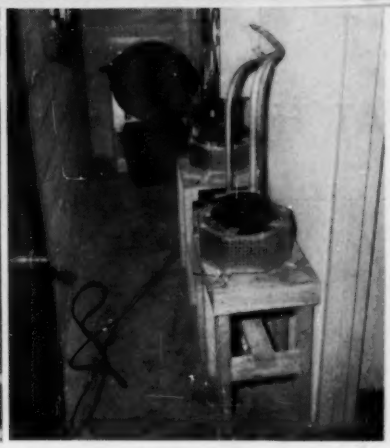
LIGHTING A COUNTRY CLUB

By Jack E. Burton
President,
Burton Bros. Electric Co.
Ft. Worth, Texas

FIREPLACE LIGHTING has dual function of providing light for seeing in the lounge area adjoining the fireplace and adding a decorative effect both by its own appearance and the way in which it highlights construction of the fireplace. The lighting consists of R-40 floods strategically mounted, concealed behind plastic sheets on supporting frame members. The lamps are aimed for even diffusion through the plastic. To properly display the characteristic color and shape of the various stones, a heavy part of the light play is directed down along the stone surface. The light catches colors in the stones and creates an artistic effect of shapes and shadows in the mortar crevises.

OPTICAL PROJECTORS are the principal lighting units in this section of the main lobby. One 300-watt, lensed unit, showing only a small spot of light from its concealed, recessed mounting (arrow), is used here to provide a high-intensity round pattern of light directly down on and confined to the round floral centerpiece on the table. Another projector of the same type is used to light the planter box at left. The box is triangular in plan and the light from the projector unit is confined to the triangular outline of the top of the box. The confinement follows the sharp edge of the box, with no light-spill over the edge.





COLD CATHODE LIGHTING above a sheet plastic covered latticework ceiling provides a comfortable, even diffusion of light in this dining room. This area is actually one-fourth of the ballroom; the walls on the left and right fold back against the wall in the background. The ballroom consists of four areas like this, side by side from left to right. The design objective here was to give the area the feeling of exposure to daylight from above. Cold cathode tubing was used for its long life and because it could be laid out in a grill pattern to provide even distribution through the plastic. At right, dimmers used to vary light output of the cold cathode tubing are shown connected to the lighting panel in a closet off the ballroom area.

ELECTRICAL construction in the "most outstanding country club in the Southwest" included installation of over $100,000 worth of lighting equipment. A variety of standard and special lighting techniques are used throughout the spacious, 115,000-square-foot clubhouse at Ridglea Country Club, Ft. Worth, Texas. And the major design contribution of this lighting is dramatic effect at night. Inside and out, the clubhouse uses light to enliven elements of the modern, luxurious appearance. In the absence of color and dimensional effect, the accompanying photos of some of the lighting techniques only half tell the story of how light "makes" the clubhouse appearance.

Electric service and distribution throughout the club is 120/208 volts, 3-phase, 4-wire. All lighting is on 120-volt circuits; power for air conditioning compressors is supplied to the motors at 208 volts, 3-phase. Engineering design of the overall electrical layout was provided by Burton Bros. Electric Co. Lighting design was a cooperative effort, including Andy Anderson, lighting engineer for Texas Electric Service, and Eric Jacksen, Wendel Western, Inc., designers and makers of all of the special lighting equipment. A significant note in this installation is the emphasis on control of light for dramatic effect rather than emphasis on obtaining high lighting intensity.

OUTSIDE VERANDA adjoins the edge of the outdoor swimming pool (right, at night) and is indirectly lighted by special 500-watt inverted wall-mounting reflector units on brick pillars of building (arrow). These units provide an upward controlled light throw which has the same intensity at its outer edge as at its center. As a result, the white, corrugated underside of the veranda roof is evenly lighted and returns a smooth play of reflected light to the veranda floor. The shadows created by the roof I-beam members add a decorative interest to the illuminated underside. The units allow a small spill of light on their underside to relieve harsh contrast with the pillar.

OUTSIDE LIGHTING in planted areas around the clubhouse is extensive, adding much to the dramatic appearance of the building. At left, a small, weatherproof, lensed unit contains a 12-volt lamp and is one of many such units used to light areas of plants and bushes. The units are rated at 25 watts and are supplied from a 120/12-volt, single-phase, 500-watt transformer. The use of high intensity beams played into the foliage from almost invisible point sources creates a striking effect. At right, a walk-lighting unit is shown in a planted area along the sidewalk leading up to the main entrance. Units like this are used to provide a smooth blanket of light over the sidewalk; the hood shields a 40-watt lamp.

By Walter J. Prise,
Queens Village, N. Y.

Checking Ball Bearings

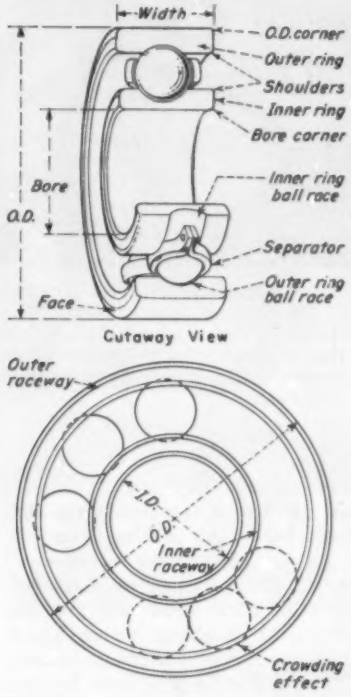


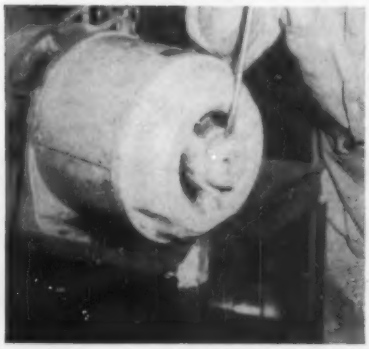
FIG. 1

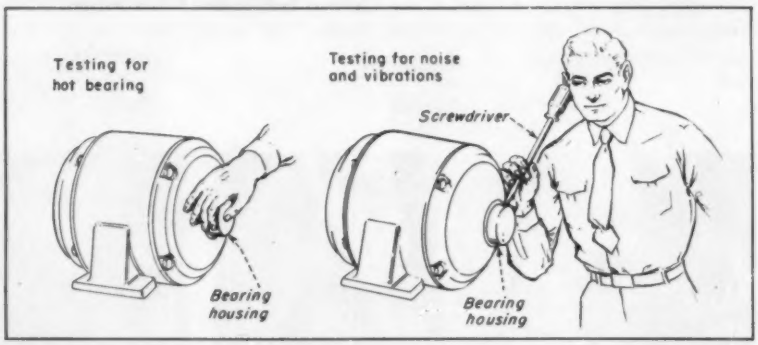
BALL and roller bearings belong to a category of so-called anti-friction bearings. The ring of balls or rollers replaces the oil film of a sleeve bearing, with the rotating action of the balls or rollers contributing greatly to the anti-friction effect.

Although anti-friction bearings are excellent in application, they provide maintenance problems which do not apply to sleeve bearings. Fig. 1 shows two views of a typical ball bearing. Each ball in the bearing is rolling between surfaces of two raceways. Because the diameter of the two raceways is necessarily different, some sliding action is introduced into the rotating of the balls. Each ball rotates with a speed which is not the speed of the inner or outer raceway, causing friction between itself and the raceways.

In any ball bearing there must be space between the balls to prevent rubbing friction between balls. If, however, the balls were not separated by some device which keeps a fixed distance between each pair of adjacent balls, the balls might group together in one section, causing excessive friction among themselves. To eliminate this result of "crowding effect", a separator is designed into a ball bearing. Separating rings keep the balls in their proper positions, although more friction is added by the rubbing between each ball and the guiding surface of the retainer or cage, as a separator is commonly called.

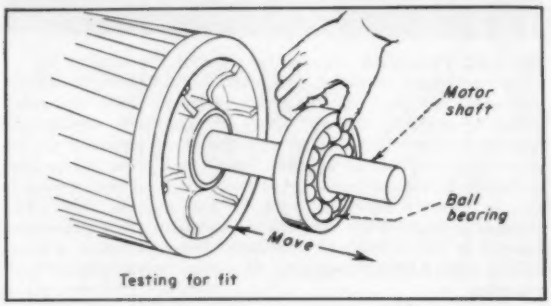
Because of the friction developed in bearings, a lubricant is required. The balls are required to carry a very heavy load; at any particular moment, only a few balls bear the total weight of the rotating part of the machine. And in addition to minimizing the friction developed, the lubricant in a ball bearing must prevent corrosion,





STEP 1. **PRELIMINARY EXAMINATION TO DETECT INDICATIONS OF FAULTY BEARING OPERATION.** The most common indicators of faulty bearing operation are: high temperature and unusual noise. A simple test for overheated bearings consists of putting a hand on the bearing housing. If the hand can withstand the heat of the running bearing, it is likely that the bearing is not dangerously overheating. To test for unusual noises, place the business end of screwdriver in contact with the bearing housing and put an ear to the handle end. An experienced and trained ear will detect any unusual or alarming noises or vibrations. The screwdriver in this test transmits and amplifies the noise through its metallic length. There are special devises made to use instead of a screwdriver in making this test.

STEP 2. **CHECKING CONDITION OF A BEARING AND ITS FIT ON A SHAFT.** If after Step 1 a decision is made to dismantle the bearing housing, the end bells are taken off the motor and the ball bearing housing is taken apart. The condition of the motor shaft and bearing raceways should be examined visually for obvious defects or wear. Scratches, scars and the like are indications of abnormal conditions such as spinning of raceways in housing, wear on shaft, etc. To test for proper fit, the bearing is first placed on a section of the shaft where it is normally located. Then by rotating the bearing, an experienced hand can tell if the fit is proper. Of course, calipers can be used to measure the inside of the bearing and the outside diameter of the shaft to see if bearing fit is proper.



to which the surfaces are susceptible.

Lubricant used for ball bearings should not deteriorate or oxidize during the period of its useful life. Such oxidation will have a bad effect on the bearing. When grease is used as the lubricant, it may become tacky and discolored. Sticky substances formed in this way adhere strongly to the inside of the bearing structure, retarding rotating action of the balls. If a ball gets frozen in its position, it wears quickly. For these reasons, care must be taken to select the proper lubricant and to apply it correctly.

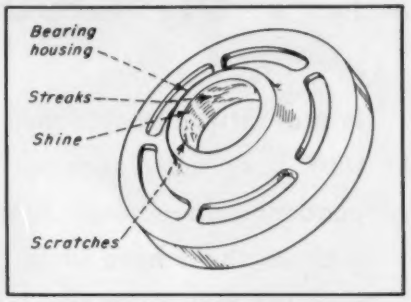
Anti-friction bearings do not require much lubrication. In fact, over-lubrication is one of the most common causes of bearing failure. More bearings are running hot because of over-lubrication than because of under-lubrication. When grease is used, the housing should not be filled up, but just to between one-third and one-half full, so that the grease level is high enough for the lower balls to pass through. If too much grease is used in the housing, the grease will tend to churn. And expansion of the lubricant due to high temperature may force oil seals to give, allowing the lubricant to escape.

The right type of lubricant for any bearing is determined during design of the bearing. The best lubricant must have characteristics suited to the applications for which the bearing is designed. Lubricating grease consists of oil and a binder. The purpose of the binder is to keep the oil in its proper place. If, through excessive heat of friction, grease is broken down, the solid matter formed as a result may interfere with action of the balls. Oil is generally used as the lubricant in bearings which operate at the higher temperatures. In such cases, substitution of grease for oil would deteriorate bearing operation. Oil as a lubricant is more stable than grease and is easier to obtain; but it must be replenished more often and must be properly sealed. A repairman, however, should never change the type of lubricant used in a bearing.

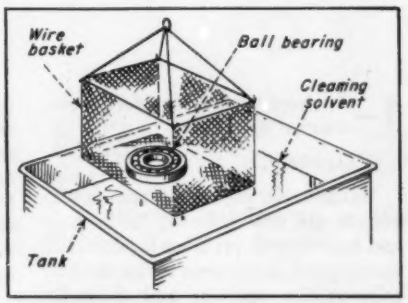
Many factors may bring about failure of ball bearings. Some of these are: high temperatures, dirt, dust, moisture, fumes, wrong fit, wrong lubricant, excessive pressure, uneven tolerances, defective materials, corrosion, improper installation of oil seals, carelessness during handling.

Substantial savings can be effected by adopting a proper method for determining if a bearing should be replaced. Replacement of bearings without sufficient indication of need of replacement can make for exorbitant cost of repair, often resulting in loss of work in competitive bidding. On the other hand, if a bad ball bearing is not replaced, early breakdown of the machine is almost assured. It is very important, therefore, to carefully check the condition of ball bearings.

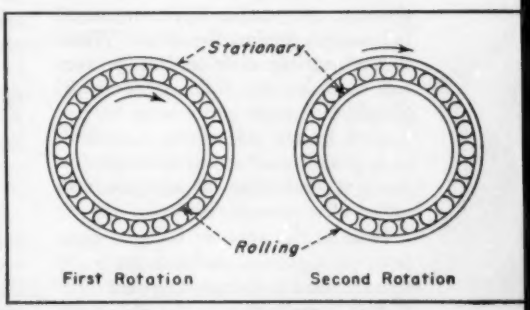
The following tests serve as a guide in checking the condition of ball bearings. Of course, practice and experience will add speed and efficiency in making these tests.



STEP 3. **EXAMINING BEARING HOUSING IN MOTOR END BELL.** As a follow up to visual inspection of the shaft and bearing raceways, the surface of the bearing housing should also be checked for scars or scratches which indicate rubbing between the surface and the outside of the bearing outer raceway.



STEP 4. **CLEANING BEARING BEFORE DETAILED EXAMINATION OF ITS CONDITION.** Before a bearing can be properly examined, it must be cleaned of oil, grease, dust and other foreign particles. A quick and effective way to clean bearings is to place them in a wire basket and dip them up and down in a tank of cleaning solvent. After the cleaning in the tank, dirt and other particles which were loosened by the solvent can be blown away with compressed air. It is advisable to filter the air supply used in this operation; otherwise, damage might be inflicted on the bearing.



STEP 5. **INSPECTION OF A BEARING AFTER THOROUGH CLEANING.** The clean bearing should be visually inspected for obvious defects. Broken balls or broken or defective retainer ring can be found this way. The bearing should be rotated in the hand, first holding the inner raceway stationary and then the outer raceway, observing the action on both sides of the bearing. This rotating will uncover uneven tolerances in the bearing. If positive evidence of defect is found in this way, the bearing should be condemned. If doubt still exists, an additional test can be made. This consists of using compressed air from a nozzle (as in Step 4) to spin the bearing. A few drops of light oil should be added to the bearing surfaces for this test. By this test, a trained ear can detect any unusual or abnormal noises in the spinning bearing. By practice and experience, this test can be used as a final indicator on keeping or discarding a bearing.

20 KEY QUESTIONS . . . on Electrical Maintenance—Part 1

Is preventive maintenance always justified? How much—or how little—paper work is actually necessary? Should work be done by in-plant crews or independent contractors? What governs frequency of inspection? . . . Questions such as these have little direct relation to maintenance techniques or know-how, yet they definitely influence Management's decisions on over-all policy, procedure, acceptance and endorsement of this vital production factor. Here, is a 14-city 9-state cross-country roundup of pertinent opinions.

1—*Do local conditions affect maintenance policies?*

Positively.

Maintenance objectives and justifications are now generally understood and appreciated, yet what is successful in one plant is not necessarily the best solution for another, and favorable local conditions in one town may not even exist in other cities.

Therefore each maintenance supervisor must weigh for himself many pros and cons and must come up with answers to such questions as: Must I subscribe completely to either breakdown or preventive work, or may I balance one against the other? Where is the sensible division line between too much or too little paper work? Should our maintenance work be performed by an independent contractor or a plant crew? Is maintenance justified for all types of equipment or under all circumstances?

Most of the answers to these questions must remain qualified, for maintenance must be balanced against other factors contributing to the philosophy of management. This philosophy is not simple, for it must consider quality and quantity of production, security of employees, plus a profit for the company and its stockholders.

Therefore maintenance has the 4-sided objective of (1) preventing down-time for personnel and equipment, (2) preventing abnormal physical depreciation of equipment, (3) preventing hazards of accident or fire which in turn could affect insurance rates or company relations with labor and the public, and (4) preventing high indirect costs related to maintenance supervision, training, costs of materials and controls, safety and tools, and so on.

Yet modern production demands efficient and constant output from all machines, equipment and operating personnel. And this in turn demands fault-free electrical systems, because today's industry depends almost *completely* upon such electrically affected factors as efficient lighting, materials-handling, heating and cooling, motor performance and control.

2—*In the 4-sided objective just cited, which point is the most important?*

None of them.

Taken by themselves, they are only contributing means to an end, that end being continuous production. Plants may be soundly engineered, with carefully selected equipment correctly installed, yet they soon can become inept unless they are intelligently operated and kept in top-flight condition. That is why *preventive* maintenance is frequently referred to as *productive* maintenance.

This latter designation is quite appropriate, for preventing breakdowns through practical electrical maintenance definitely provides the key to quality-quantity production. It is also synonymous with plant efficiency, economy and safety.

3—*Can all industrial plants afford the luxury of maintenance?*

The question is redundant.

Maintenance is not a "luxury"; it is a necessity. Ignoring this fact can lead an industrial plant to the verge of economic suicide. No plant can operate effectively for very long without planned inspections, adjustments, cleanings, replacement of worn parts, lubrication and repairs. Therefore no plant can afford the luxury of ignoring it.

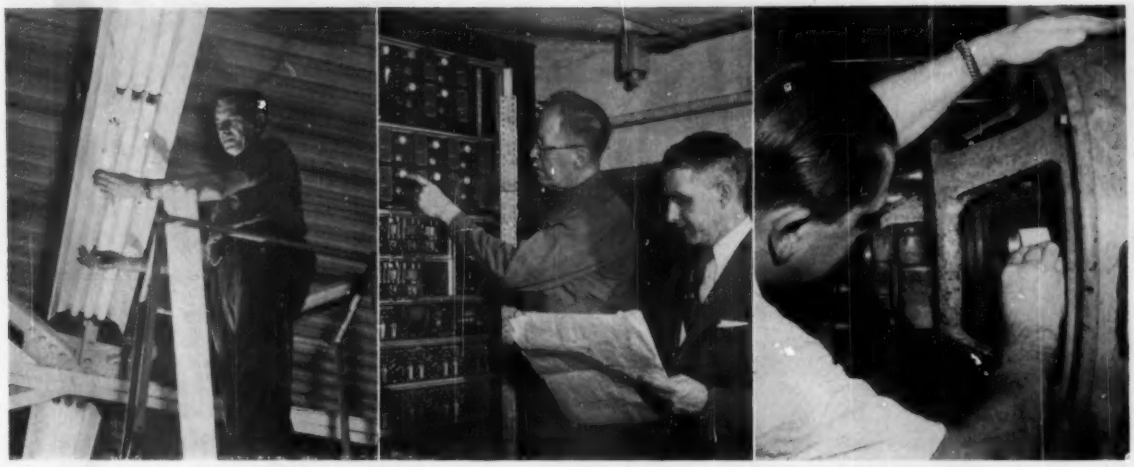
4—*How many basic requirements are involved in a maintenance program?*

Four.

Simply stated, maintenance requires (1) Manpower, (2) Materials for replacement or service, (3) Paper work to a certain extent, and (4) Tools for performing the work effectively.

Depending upon the size and nature of a plant, however, this simple formula can become extensive and involved, or it may be limited to a few basic routine procedures.

Manpower, for example, includes not only men who actually perform the work, but those who plan, supervise and schedule. It also includes



COMPREHENSIVE MAINTENANCE should consider all machines and equipment connected to or served by the wiring and controlling components, such as the fluorescent lighting system of The Reliance Electric and Engineering Co., Cleveland (left); the electronic control panel that automatically operates the elevators at Lever House, New York, N. Y. (center), and motors, such as the one pictured above (right) receiving a periodic commutator sanding by a service electrician employed by the Maintenance Company, New York City. Welding, heating, transportation, communications and material-handling equipment likewise merits attention.

clerical help for filing, a stockroom supervisor, purchasing agent, training director and the like. In small plants where electrical equipment is not too extensive, all of these functions may be performed by a small force; many or all of the functions sometimes being performed by a single individual. Large, extensive, continuously operated plants, on the other hand, frequently have maintenance organizations with personnel numbering well up into the hundreds. And, conjunctionally, manpower also creates problems in human relations, labor relations, safety indoctrination, insurance and the like.

Materials and equipment related to service and replacement of faulty or deteriorated parts may also become an extensive problem, for this item involves inventories, protection, storage, breakage, obsolescence, re-ordering and so on.

Paper work to some extent is also essential in a preventive maintenance program, particularly motor records, test data, inventory cards, cost analysis, check-lists, procedure outlines, survey reports, wiring plans and the like. When carried to excess, paper work can be a burden and defeat its own purpose, yet records in some form are absolutely essential if performance of equipment is to be studied intelligently.

Finally, tools necessary to complete the maintenance work should be emphasized, for this includes a wide range of hand and power tools, scaffolding, and repair program to keep everything in peak condition.

5—*Can independent contractors provide reliable maintenance for industrial plants?*

Absolutely.

Since requisites for preventive maintenance can become extensive, many small and medium-sized industrial plants frequently feel that they cannot afford a maintenance program. In this belief they are wrong, for they are erroneously assuming that a maintenance *program* requires an *in-plant* maintenance organization.

That is not so because, by signing contracts with companies specializing in this type of work, they can obtain reliable, prompt and economical service and, therefore, can secure the benefits of maintenance without personally embracing may of the problems related to it.

Large maintenance organizations (with a large volume of business resulting from having many customers with similar electrical requirements) can justify many major investments that a small industrial plant can not. For example, they can employ full-time specialists, provide continuous night-and-day emergency call service, purchase and repair efficient tools, instruments and meters, install modern shop equipment and maintain a comprehensive stock of replacement parts.

6—*What type of electrical equipment can be maintained by contract?*

Practically everything in the system.

In general, an electrical system can be segregated into four distinct types of equipment: (1) the basic components, such as transformers, switchgear, feeders and duct systems, (2) rotating machinery, including motors, generators, m-g sets and converters, (3) special equipment, such as electronic devices and rectifiers, and (4) lighting equipment which may be either fluorescent, incandescent or mercury-vapor. More and more electrical contracting companies are providing service for one or more of these four groups, so a plant without its own crew should have little trouble obtaining maintenance to meet its requirements.

7—*When is maintenance by contract advisable?*

That question can be answered only after evaluating many factors affecting maintenance.

For example, industrial plants may wish to subscribe completely to any or all of the four maintenance categories just mentioned, or they may wish to subscribe to one or more of them to a limited extent. Even this partial adoption has merit, for having some of the work performed by an

INTELLIGENT ORGANIZATION should consider an ample stock of replacement parts, stored for safety, convenience and fast identification, such as in rotary bins as used by the Holt Electric Motor Co., Milwaukee, Wis. (left). Also essential is a certain amount of paper work, such as check-lists, motor records or inventory cards such as the Kolect-A-Matic file (center) developed by Remington Rand, New York, N. Y. And, above all, preventive maintenance requires men with necessary know-how, as typified by electricians from the California Electric Works, San Diego, Cal. (right), shown repairing controls.

"outside" contractor may then make it possible to eliminate one plant-crew work-shift, or make it unnecessary to employ a man with special talents for full time when, actually, he would be performing that specialized service for only brief intervals.

The wisdom of signing a contract, therefore, calls for the evaluation of everything related to maintenance. This includes the annual expense (for labor, parts, tools, bookkeeping, inventories, insurance and so on), the reduced responsibility and supervision required, and the securing of better plant operation in exchange for a legitimate charge.

8—*Does a maintenance contract have any secondary benefits?*

Yes, quite a few.

In addition to possible economies that may be attained directly by obtaining labor and materials by contract, there are other associated advantages which are less apparent but equally important. These may be called "fringe" benefits.

Take the detail of inventory. Under a contract arrangement, the plant owner is relieved from all problems related to invested capital, occupied storage space, or possible loss through fire, breakage or pilferage.

Furthermore, compliance with all work laws and ordinances is assured, liability claims are remote, work is guaranteed, unexpected charges are eliminated, and extra labor can be summoned for emergency repairs merely by phoning for service.

9—*Are charges for labor higher when the work is done by an outside contractor?*

Not necessarily.

In balancing inside labor against outside contract work, it is a natural thing to first equate labor rates. This can be misleading, however, because outside labor is usually figured on an hourly rate whereas in-plant crews are generally paid an annual salary.

Outside labor charges also include travel time to and from the plant, and it would have to be marked up to also cover overhead and profit for the contracting company. This would initially indicate that outside labor is comparatively expensive.

It should be remembered, though, that direct labor is the smallest part of a maintenance program, for there still are the costs of parts, storage, administration, supervision, bookkeeping and the like. These overhead charges more than equal the basic cost of labor (and they naturally would have to be paid directly by those who have their own maintenance departments), so the apparently high hourly charges for outside specialists are generally quite realistic and fair.

So long as maintenance remains sufficiently minor to warrant only part-time attention, the advantages of outside contract work remain strong. When the size of the plant is such, however, that maintenance men are working quite constantly, then it becomes practical to consider organizing an "in-plant" crew or department.

10—*When is a plant economically justified in establishing its own maintenance?*

That question, also, depends upon several considerations.

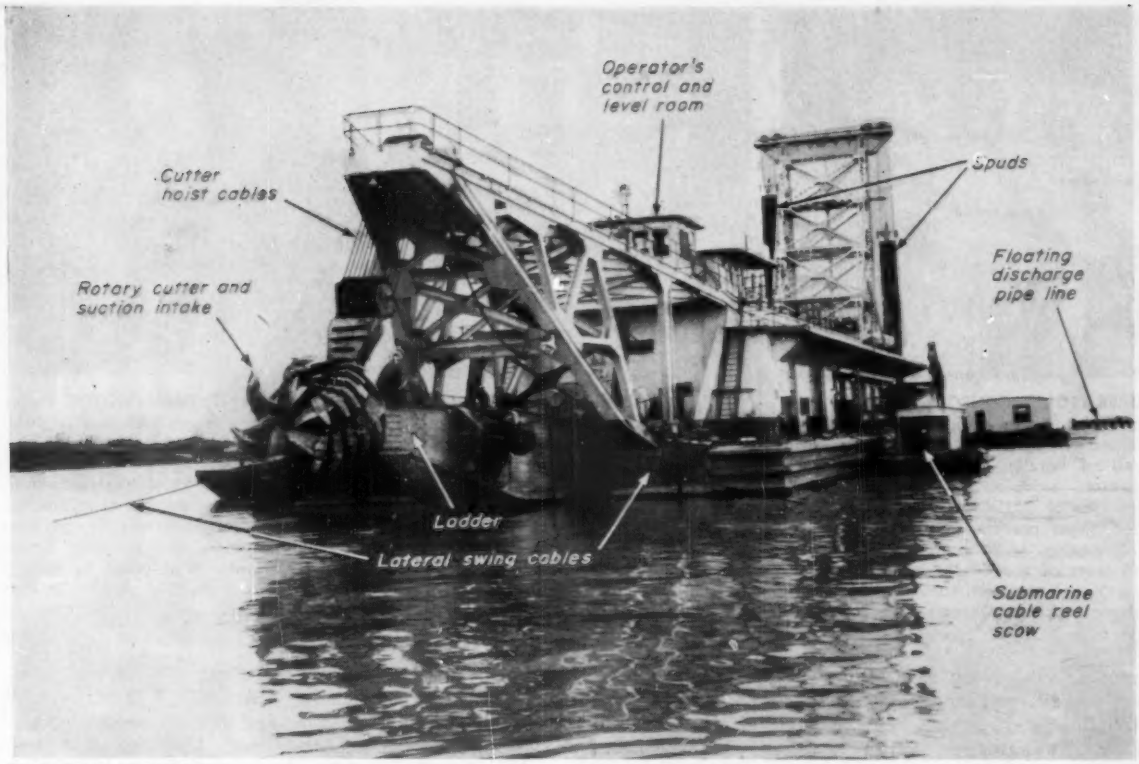
The larger the plant, of course, the greater the advisability becomes for organizing a plant maintenance department, for then the men can be trained for specific duties and are readily available in the event of emergencies; while record systems, stocks, maintenance techniques and departmental cooperative problems can all be studied with a specific plant or condition in mind.

The questions, therefore, are not whether preventive maintenance should be subscribed to but, rather, how will it be performed? Who will perform it? Which approach will give better and more economical results?

It is apparent that these answers will vary from plant to plant, depending upon size, type of operation, available labor market, contractors and shops in the neighborhood specializing on this type of service, and so on.

Then there are many special considerations such as, for example, a plant doing considerable governmental work of a classified nature. In these cases, security measures might be such that frequent employment, investigation, screening and approval of outside labor would not be advisable or feasible.

Research and development plants might also prefer their own employees to service equipment, in order to restrict dissemination of information.



THE "HYDRO-QUEBEC", world's most powerful dredge, has overall length of 280 feet, displacement of 2500 tons, and peak power demand exceeding 20,000 horsepower. Operational power is obtained via submarine cable extended from mobile shore-based 10,000-kva 44/13.8-kv substation. All operations of the cutter, pump, swing winch, ladder and spuds are controlled from upper-deck lever room.

Power and Control for a

DREDGING GIANT

Most powerful pipeline dredge in existence—with peak power demand exceeding 20,000 horsepower—has metal-clad switchgear, electrically-operated breakers, current-balancing relays, surge capacitors and automatic liquid-rheostat load regulators. Primary power at 13.8-kv is obtained through submarine cables extending from shore-based trailer-mounted 10,000-kva substation.

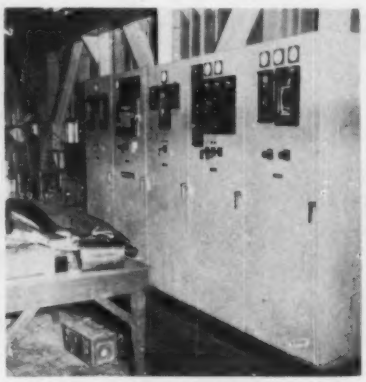
By M. A. Neslin, *Industrial Application Engineer, General Electric Company*

ALMOST vital link in the now-a-building St. Lawrence Seaway project is the Beauharnois Ship Canal—a 15-mile waterway (some 25 miles southwest of Montreal) that connects Lakes St. Louis and St. Francis through a series of stepped locks. Collectively, these locks add up to an 80-ft water-elevation differential and, when the canal is completed, the entire St. Lawrence River can be diverted through this new channel. Coincidentally, the water will also activate a Quebec Hydro Commission powerhouse having a whopping capacity of 2.2-million hp.

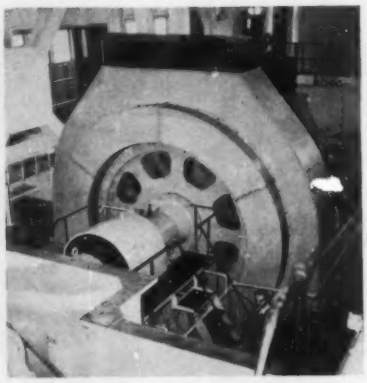
Before the canal becomes a reality, however, 40-million cubic yards of glacial boulders and clay must be dredged from the channel and deposited on shore. And, for this purpose, the Ellicott Machine Corporation of Baltimore designed the "Hydro-Quebec"—the world's largest, most powerful dredge to be constructed to date.

Operating on a round-the-clock 6-day-week basis with a 16-man crew, this water-borne giant is now chewing a 27-ft-deep 600-ft-wide channel—

OPERATOR'S CONSOLE in upper-deck control room is equipped with horizontally-moving handles for electric control, vertical handles for auxiliary hydraulic control. Glass panels permit unobstructed view of all dredging operations; dials and gages provide constant operational information, while communications with all parts of the dredge are possible via signal buttons and conveniently-located phone installation.



MAIN SWITCHGEAR is a 13.8-kv 1200-amp metal-clad heavy-duty vertical-lift draw-out assembly. Cubicles (left to right) contain 1200-hp synchronous motor feeder for cutter m-g set, 600-kva station service transformer feeder, 600-hp synchronous motor feeder for hauling winch and ladder hoist, 8000-hp w-r induction motor for pump, and incoming line compartment for 13.8-kv grounded-neutral service.



DUE TO SIZE OF PUMP MOTOR (note comparative size of man at lower right), unit was load-tested after installation, using the direct-coupled pump as the actual loading. Electrical measurements were confirmed by additional hydraulic tests, using calibrated nozzles on the pump discharge for that purpose. Temperature of stator is obtained by resistance detectors embedded directly in the motor windings.

gouging out half-ton 30-in boulders in the process, gulping them through a 17-ft diameter pump, then flinging them shorewards through a 1500-ft floating pipeline.

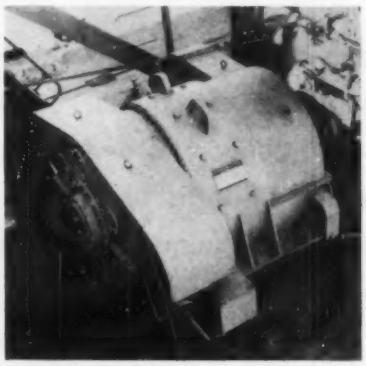
Basically, the dredge is a hydraulic excavator, with a forward cutter to loosen submerged materials and a pump to suck up and discharge the resultant muck and debris. In operation, the dredge oscillates alternately around two 90-ton tern pivot spuds; speed and magnitude of arcs being controlled with anchored wing-cables and take-up drums; and forward progress of the dredge being accomplished by alternately lifting and dropping the spud legs as the excavator swings back and forth.

Everything related to this dredge is king-sized; from the 5-ft average "cut" and 10-ft average forward "stride" to the 8000-hp pump, 1000-hp cutter, 600- and 1200-hp m-g sets, and motors (for swing-winches, spuds and ladder) ranging up to 200-hp in capacities. Rated horsepower of all major machines and transformers totals 18,170-hp (of which 12,180-hp can be connected and operated simultaneously). And, since practically all of the machines can handle momentary loads of 200%, it is conservatively estimated that the excavator's peak power demand is well above 20,000 hp.

Power for the "Hydro-Quebec" is supplied through a mobile 10,000-kva substation mounted on a 50-ton trailer. This station steps primary 44-kv power to 13.8 through a fan-cooled transformer equipped with all necessary breakers and related controls. Grounding for the neutral is two-fold: via rods (driven conventionally on shore), plus a large copper plate (skidded along the bottom of the canal as the work progresses).

From this mobile substation, 13.8-kv power is carried first to a reel scow (moored alongside the dredge), then to the metal-clad main switchgear and (via bus structures) to switching cubicles.

Submarine cable is 4½-in. neoprene-jacketed, containing three 450MCM power, and three 2/0 ground conductors. This cable is kept straight and unsnarled through use of the floating cable reel (capacity 4000 ft), while temperature-rise is minimized through use of water-sprays aboard the scow.



CUTTER MOTOR, coupled to gear box, is mounted directly on the ladder frame. Weatherproof 600-v dc 1000-hp unit is capable of operating at 45-degree axial tilt. Motor has forced ventilation with blower mounted in air intake on far side of coupling end, while commutator end has portholes for examining commutator and air discharge ducts. Motor is designed to handle shock load of 200% for one minute.

13.8-KV Switchgear

Switchgear circuit breakers are metal-clad heavy-duty indoor units, with vertical-lift draw-out features, capacities of 1200 amps, and ICs of 250,000-kva. All power breakers are electrically closed; automatically or manually tripped. All breakers are also installed in duplicate, while a spare breaker on the dredge makes it possible to remove and service any unit without interrupting operations. Protection of loads is provided through instantaneous and time overcurrent, undervoltage and phase-sequence relays.

Initial closing of breakers is performed locally by a trained switchboard operator although, once breakers are closed, individual drives are then controlled remotely by the dredge captain who is stationed in a top-side clear-view lever room. To insure coordination of switching, switchboard and lever room locations are connected through both buzzer and telephone circuits.

In addition to normally-included metering and instrumentation dials, main switchgear is equipped with a watt-hour meter (showing total energy consumption) a power-factor meter, a recording wattmeter (show-

"Is this size approved?"

"brother... they're ALL approved!"*

SERVIT

Type KS

Know your Burndy SERVITS:
Compact, easy to tape, easy to install; less tightening torque needed because there's less loss through friction. Connector head fits over run conductor easily, exactly matches length of pressure bar for greater distribution of contact pressure.

*on all sizes through 1000 Mcm.

BURNDY

65-10

Norwalk, Connect. • Toronto, Canada • Factories: New York, California, Toronto • Export: Philips Export Company

get a better grip on your job with

Interlocking channels . . . a Channellock exclusive

Re-inforced tension edge . . . another Channellock exclusive

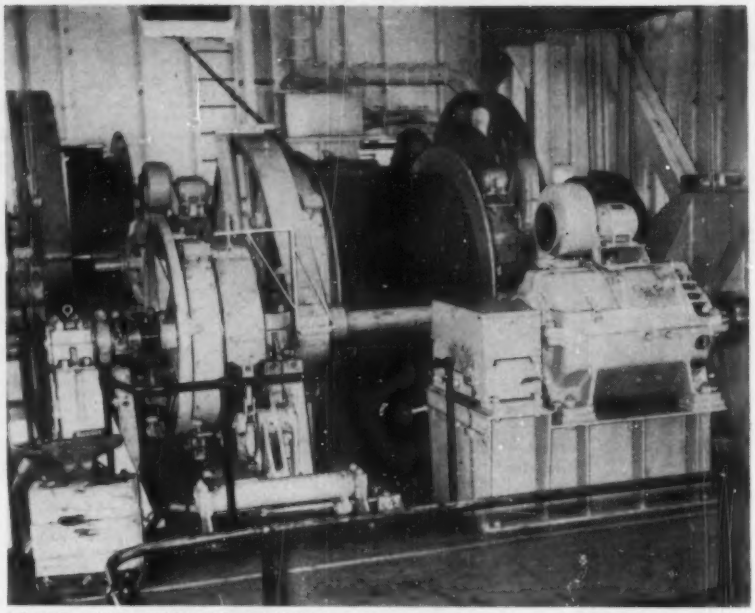
CHANNELLOCK

No. 420

"Grips like a pipe wrench!" "A cinch to use in hard-to-get-at places". Reasons why Channellock No. 420 is the first choice of skilled mechanics . . . everywhere. And *only* Channellock has the interlocking channels that can't jump out no matter how hard you grip. *Only* Channellock has the re-inforced tension edge to withstand maximum gripping force. So when you ask for a Channellock, be sure you get *genuine* Channellock. Look for the trade mark on the handle.

CHANNELLOCK
first choice of skilled Mechanics

CHAMPION DeARMENT TOOL COMPANY
MEADVILLE PENNSYLVANIA



LADDER AND HAULING WINCHES (center and sides) are powered by 187½-hp 230-v mill-type motors, each having a peak momentary capacity of twice its normal rating, and each equipped with a series-operated Sirocco blower. Speed-load characteristics are straight-line functions, thereby protecting equipment from damaging strains. Operation is controlled remotely from upper-deck lever room.

ing peak demands), a recording temperature meter related to the pump motor (with resistance temperature detectors embedded in motor windings), plus recording tachometers and ammeters for pump and cutter motors alike.

Protection for the pump motor is provided through current-balanced relays (preventing single-phase operation), differential relays (detecting internal faults and grounds), plus surge capacitors. Surge capacitors also protect the cutter's m-g set, which is likewise equipped with synchronous-speed and incomplete-sequence relays.

All power transformers (four in all) are Pyranol-immersed self-cooling units with four 2½% taps on the primary (13.8-kv) sides. Padlocked tap changers, with operating handles outside the tanks, are also provided for de-energized operation. Vertical take-off is possible through high-voltage, low-voltage and neutral bushings, while dual low-voltage (secondary winding) ratings are obtained by means of a series-multiple terminal board, accessible through top-of-tank manholes.

8000-HP Pump Motor

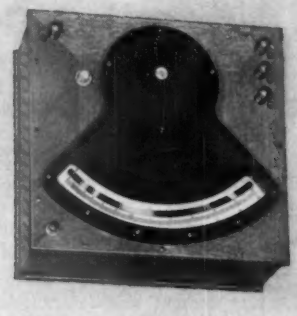
Due to the nature of load on the 8000-hp wound-rotor pump motor (continuously varying from pure water to mixtures of sand, clay and boulders), the motor was designed to include Class B insulation throughout, a 200% breakdown torque and special moisture-resistant insulation. Protection was further insured by installing corrosion-resistant fittings, resistance temperature detectors, a drip cover and bearing temperature relays.

Pump speed under load is controlled by a liquid rheostat regulator, permitting the operator to match speed with varying conditions of suction and discharge heads, density, discharge velocity and tail-pipe length. Additional control is provided by means of an emergency stop, located on the dredge bridge, that can remotely open the pump motor circuit breaker on the main switchboard.

In the event of large rocks jamming the pump, an automatic torque-motor regulator can reduce the load from maximum to minimum conditions in 2½ seconds (much faster than a man could respond manually). However, to prevent the regulator from adjusting the load for each individual boulder, sensitivity is adjusted for only a 5% or greater load change.

This liquid-rheostat load regulator is of latest design, utilizing a separate heat exchanger that pumps canal water through heat exchanger tubes immersed in the regulator's electrolyte tank. Opening and closing of the valve in the cooling water line is controlled by a thermal element immersed in the electrolyte solution,

*1/10 OF 1%...LABORATORY STANDARDS



the primary instrument standards the world over... for instrument checking and maintenance, and wherever measurements must be made to a high degree of accuracy. Available as D-C Voltmeters and D-C Ammeters, and as A-C and D-C Voltmeters, Ammeters, and Single Phase Wattmeters.

*1/4 OF 1%...PORTABLE STANDARDS

the portable reference standards, for checking instruments, certified test work, and laboratory measurements. Available as A-C and D-C Voltmeters, A-C and D-C Ammeters and Milliammeters, D-C and Single Phase A-C Wattmeters, Poly Phase Wattmeters, Power Factor Meters, Frequency Meters and Phase Angle Meters.

*ACCURACY RATED

Weston's comprehensive selection of accuracy ratings enables you to choose instruments which *exactly* meet your measurement needs from every standpoint...*conservatively rated accuracy, long life, low cost.* For literature, consult your local Weston representative, or write direct.

WESTON Instruments

WESTON Electrical Instrument Corporation

614 Frelinghuysen Ave., Newark 5 N. J. — *A subsidiary of Daystrom, Inc.*

*1/2 OF 1%...WORKING STANDARDS

the rugged portables for general test work where long, readable scales and high shielding are desired. Available as D-C Voltmeters, Ammeters, Milliammeters and Volt-Ammeters; and as A-C Voltmeters, Ammeters, Milliammeters, and multi-range Ammeters and Voltmeters; A-C and D-C Single Phase Wattmeters.

*1%...FIELD AND SHOP INSTRUMENTS

Miniature D-C portables for accurate measurements in shop or field. Available in all required ranges as D-C Voltmeters, Millivoltmeters, Ammeters, Milliammeters, and D-C Volt-Ammeters.

RAWL-ANCHORS TAKE 2000 POUND BLOWS ALL DAY LONG FOR OVER A YEAR!

THE CUSTOMER SAYS:

"The Chas. A. Burton, Inc., who re-modernized our loading dock, used Rawl products and they have proven very satisfactory under severe holding conditions."

THE CONTRACTOR SAYS:

"We like Rawl products! But, that is not all—we like the engineering help you have given us in solving the tough jobs.

To be specific—on the Neal Properties job at 9800 Detroit Avenue, Cleveland, Ohio, we had the job of fastening some 12" x 12" wooden bumpers into a common brick wall in front of four unloading doors in an existing building. We figured the bumpers would receive at least a 2000 pound blow every time a truck backed into them, and therefore they had to be be securely anchored.

We asked you for your recommendations on how to fasten these bumpers. You suggested one method which we followed and it worked "beautifully"; and after one year still is showing no signs of loosening up. It was one of those "headache" jobs and your help was invaluable. The solution—we cut a 1¼" hole 4½" deep into the brick work with a 1¼" carbide drill. Then we inserted a ¾" x 16" machine bolt with the head end into the hole. Over this we slipped two ¾" rawl anchors on the bolt and caulked them into the hole by using a piece of 1" steel pipe 24" long. Using two rawl anchors in tandem does the trick. They really hold. Recently a truck caught on the angle iron protecting the top edge of the wooden bumper and pulled the angle iron off, but the rawl anchors holding the wooden bumper held on and didn't budge."

Write for Catalog, prices and free Dimensional Chart.

THE RAWLPLUG Co., Inc.
271 Church St., New York 13, N. Y.

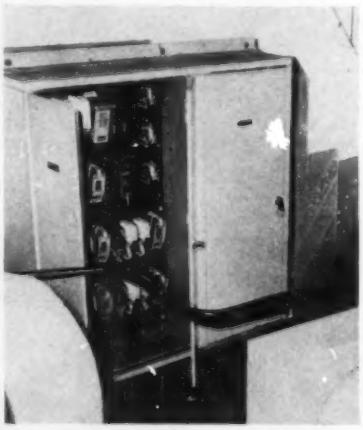
thereby preventing wide variations in electrolyte temperature and resultant variations in the resistance of the pump motor's secondary.

Cutter Has 200% Shock Margin

Severe electrical and mechanical shock loads are also provided for in the design and control of the 1000-hp cutter motor, with overloading of 150% permissible for five minutes, and 200% for one. The severity of these shock loads can be appreciated by considering that the cutter is driven by a solid steel shaft 14 in. in diameter, it operates from the foot of a 375-ton ladder, and its reactive force has to buck the inertia of the 2500-ton dredge.

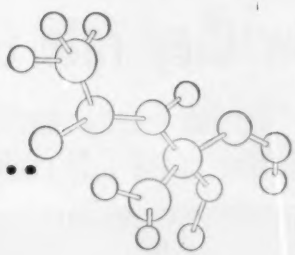
In this case, motor speed is balanced with load by means of an amplidyne control circuit having an overriding current limit. The sensing element for loading is a tachometer generator, mounted on the cutter motor, which feeds back a voltage proportional to the speed selected. Therefore shock loads tend to decelerate the cutter motor, causing the current to increase. This in turn causes a voltage drop in the armature loop and initiates current-limiting action in the amplidyne control field.

Speed control is most important, due to the varying nature of the channel bottom from solid rock to clay and sand. Therefore the operator can set the speed reference with the master switch by means of ten points for-



CONTROL PANEL FOR SPUD HOIST motor has secondary cast grid resistors, magnetic contactors and 5-point hoisting and lowering control. Should spud become stuck in channel bottom, operator can place controller on fourth point to provide maximum locked-rotor torque until spud is pulled free. Located at right is 600-kva 600-v Pyranol transformer. Standby power is provided by 125-kw diesel-driven alternator.

Du Pont changed some molecules...



to produce the higher heat resistance of ALATHON®

polyethylene resin

From the Du Pont laboratories comes "Alathon" polyethylene resin with increased heat resistance for insulation and jacketing. This extra measure of protection for copper and aluminum conductors is in addition to other important properties, such as weatherability.

Jacketing of "Alathon" has outstanding dielectric strength. This material is lightweight and pliable; users find it easy to handle. Jacketing of "Alathon" provides real economy because it lasts for years without festooning or splitting. Another advantage is its low rate of water absorption.

For more property and application data on the family of Du Pont "Alathon" polyethylene resins, clip and mail the coupon below.

There is a difference in polyethylenes - specify ALATHON®
polyethylene resin

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

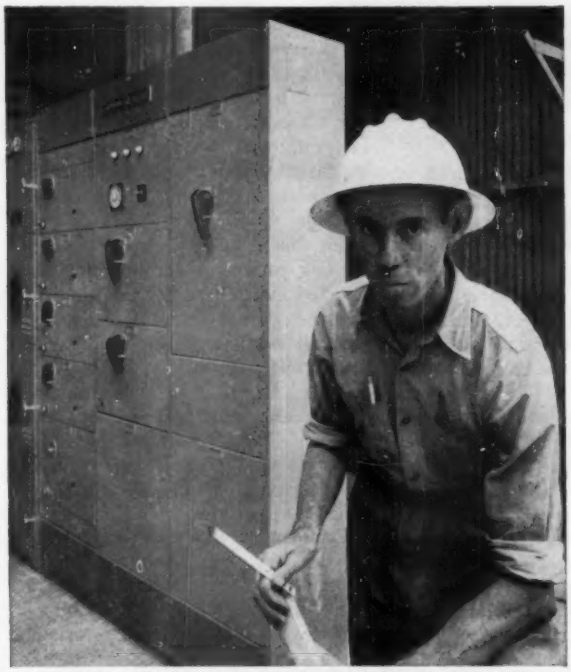
E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 4412, Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited, P. O. Box 660, Montreal, Quebec.
Please send me complete information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for.....

*Name*_____ *Position*_____
*Firm Name*_____
*Street Address*_____
*City*_____ *State*_____
*Type of Business*_____

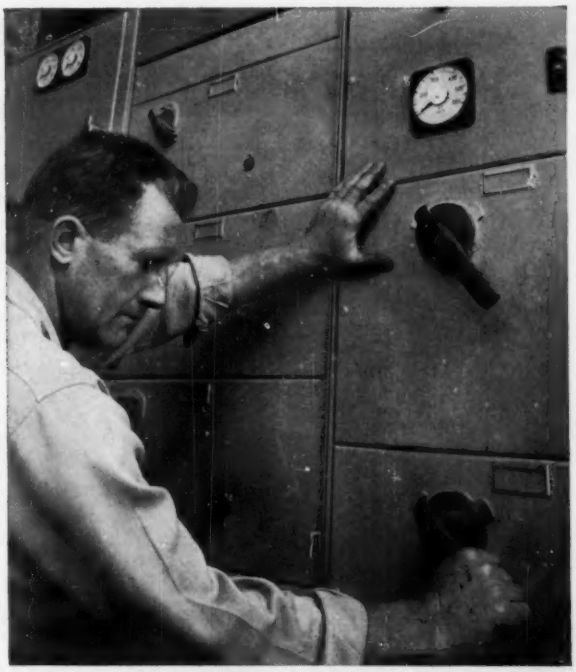
Contractor and Engineer tell in their own words how they rate G. E.'s new motor control center

"Our job greatly simplified," states electrical contractor A. G. Crunkleton —"Nothing in the field could equal this equipment," says plant engineer Henry Roth.

"Here's what we ran into at North American Cement," says A. G. Crunkleton, President of Crunkleton Electric Company, Greencastle, Pa. "Our job was to design and install a system that could withstand their rugged operating conditions and provide flexibility to meet increased future loads. We selected the General Electric DA7093 Control Center because it met those requirements and because it offers maximum protection to motors and circuits in the event of overloads or shorts. From the contracting point of view, our job has been greatly simplified and improved because, for one thing, the G-E Control Centers are designed for specific customer demands. The guesswork is eliminated. We work very closely with the G-E people, and they factory-fabricate the equipment to my customers' specifications. When I receive it, it's ready for quick and easy installation."

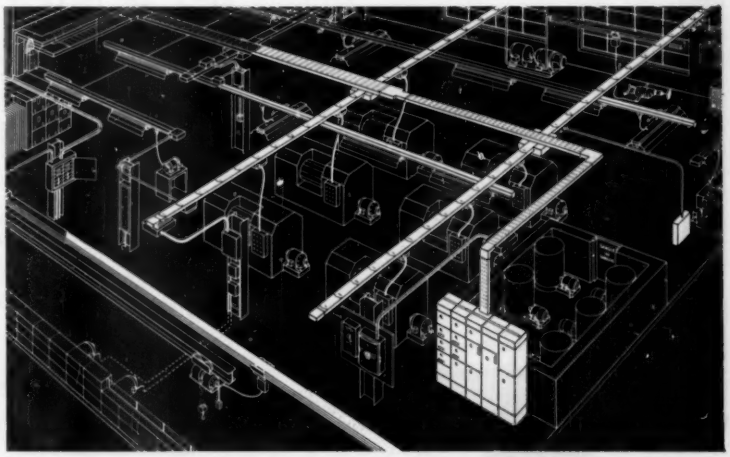


A system to meet both present and anticipated power loads. Henry Roth says, "We recently replaced some G-E switchgear after 28 years of continuous operation. Having learned to expect this dependable kind of service from General Electric equipment, we replaced with G.E.'s Type DA7093 Motor Control Center that you see here. Heavy-duty limestone pulverizing like we are doing at Hagerstown, (Md.) demands equipment that's durable, easily maintained. We can't tolerate even an hour of lost time in our around-the-clock operation, 365 days a year. That's one reason we chose the DA7093. In addition, this G-E design has built-in flexibility. For example, units can be interchanged to accommodate larger motors, and whole sections can be added to handle increased loads. Our new G-E Motor Control Center gives us the reserve capacity and unusual flexibility we'll need to keep pace with the growing and shifting requirements of our plant."



Designed to meet contractor's needs and cut installation time. "This is the age of automation," says Mr. Crunkleton. "This means a constant advance in the power requirements of industry, and puts greater responsibility on the contractor. For example, the recommendation of an electrical control system of the type we designed for the North American Cement Company carries a lot of responsibility, because of the critical part played by the motor control in their operation. Our job evolved itself into designing and installing a motor control system which would handle the present load *and the future load* of the plant. After three weeks of study and investigation of the problems in collaboration with Mr. Roth and his people, we selected the General Electric Type DA7093 Motor Control Center as the answer to the most efficient handling of the heavy duty demands. And I might add that the G-E equipment helped cut installation time."

The Type DA7093 Motor Control Center (shown in layout) is an integral part of G.E.'s secondary distribution system, which also includes switchboards, busway, unit substations and panelboards. This "system engineered" equipment gives user and contractor seven *work-together* advantages—1. *True extendability* because G-E standardized components are especially designed for easy addition or relocation. 2. *Easy-to-assemble.* 3. *No loss when moving.* "System Engineering" provides for practically 100% re-use of materials. 4. *Complete relocation of loads* without rewiring. 5. *Maximum electrical efficiency* from components designed to work together. 6. *One source of supply* for all components. 7. *Skilled planning service* from the G-E Engineer who is selling not just components but "System Engineered" equipment to assure installations with a built-in future. **Distribution Assemblies Department, Plainville, Connecticut.**

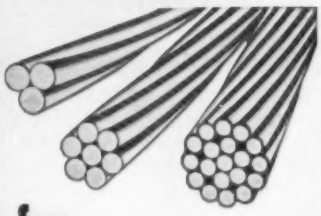


Progress Is Our Most Important Product

GENERAL ELECTRIC

ACCO Quality

PAGE Stainless Steel Strand



for Severe Service Conditions

PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! Its lower cost per year of use means long-range economy.

Write us at Monessen, Pa., for complete information

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

for Better Value

ward (seven at constant torque and three at constant horsepower) and two points in reverse (both at constant torque).

Winch, Ladder and Spuds

The swinging or hauling winch is powered by two 187.5-hp 230-volt mill-type motors in series with a 325-kw generator, and this unit has a momentary peak capacity of 800-hp.

To maintain taut swing lines at all times, and to protect swing wire ropes from sudden jerks and strains, speed-load characteristics are maintained as a straight shunt.

The control for this swinging winch is magnetic, with 19 points of generator field control (16 points of generator voltage at constant torque and 3 points of field weakening).

The ladder hoist motor is similar in capacity and control to one of the swing-winch motors, with the exception that the magnetic control has only five points of generator field control. This is ample, for the duty of the ladder is to lift fairly-constant loads.

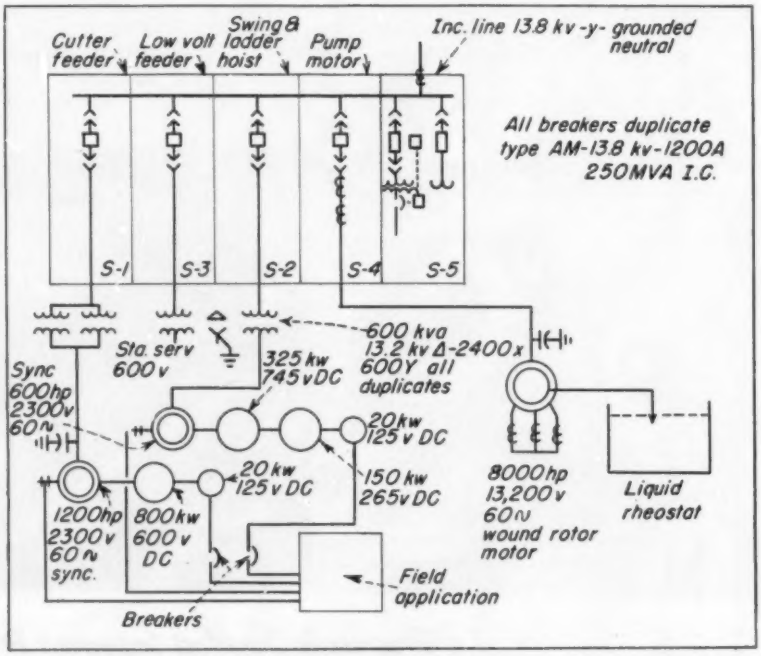
Protective features of the ladder hoist are likewise similar to those of the swing-winch, although the ladder hoist has an additional 60-hp wound-rotor motor with corrosion-resistant secondary resistors and an 8-point reversing drum controller.

The hoist motor for the spuds has normal characteristic for raising a definite non-varying load. However, should a spud become stuck in the channel bottom so tightly that it will not come free in a given time-delay interval, the operator can obtain maximum torque with locked rotor and then exert maximum, continuous pull until the spud is loosened.

On this king-sized dredge, the operator's console is located for unobstructed visibility of all dredging operations, and it was designed to provide easy access to all controls, lessen operator fatigue as much as possible, and provide constant information concerning all operational conditions. Therefore the console is equipped with both electric and hydraulic levers, plus indicating gages to reveal pump, cutter and winch action.

Communications with all parts of the dredge are available through the mediums of conveniently-located telephone and buzzers, thereby making it possible for the operator to contact all key personnel without shifting his gaze from the dredging operations.

On this, the world's most powerful dredge, therefore, severe conditions of mechanical shock, vibration, tilting, dynamic overloads and adverse atmosphere, plus the demands for critical control and reduced maintenance, are all satisfactorily obtained by this concentration of power and control.



POWER FOR THE "HYDRO-QUEBEC" is received at shore-based mobile substation at 44-kv where it is stepped to 13.8-kv and carried via submarine cable to main switchboard on the dredge. Note that two distinct field-application equipments are mounted in one separate compartment. Closing of breakers is manual although, once breakers are closed, control of drives is from remote lever room on upper deck.

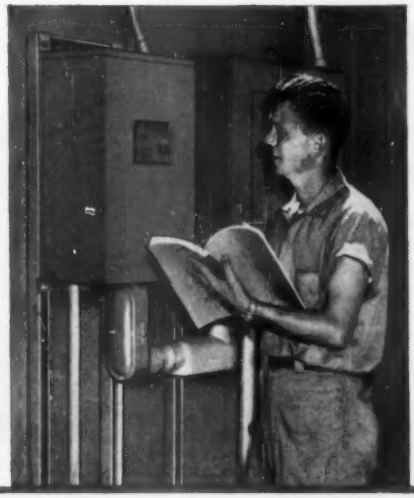
LOOK!

A Dry-Type Transformer with Class H Insulation

(150 C Rise)

Here's a completely new line of totally enclosed dry-type transformers with Class H insulation. Maintenance is completely eliminated. Dust and dirt are kept out. No more worrying about the effect of lint or moisture in the atmosphere. You can use them indoors or outdoors — they are completely weatherproof. And the compact Allis-Chalmers design gives you lower weights, reduced dimensions. In many cases installation will be less costly, easier.

All these advantages at little or no extra cost!

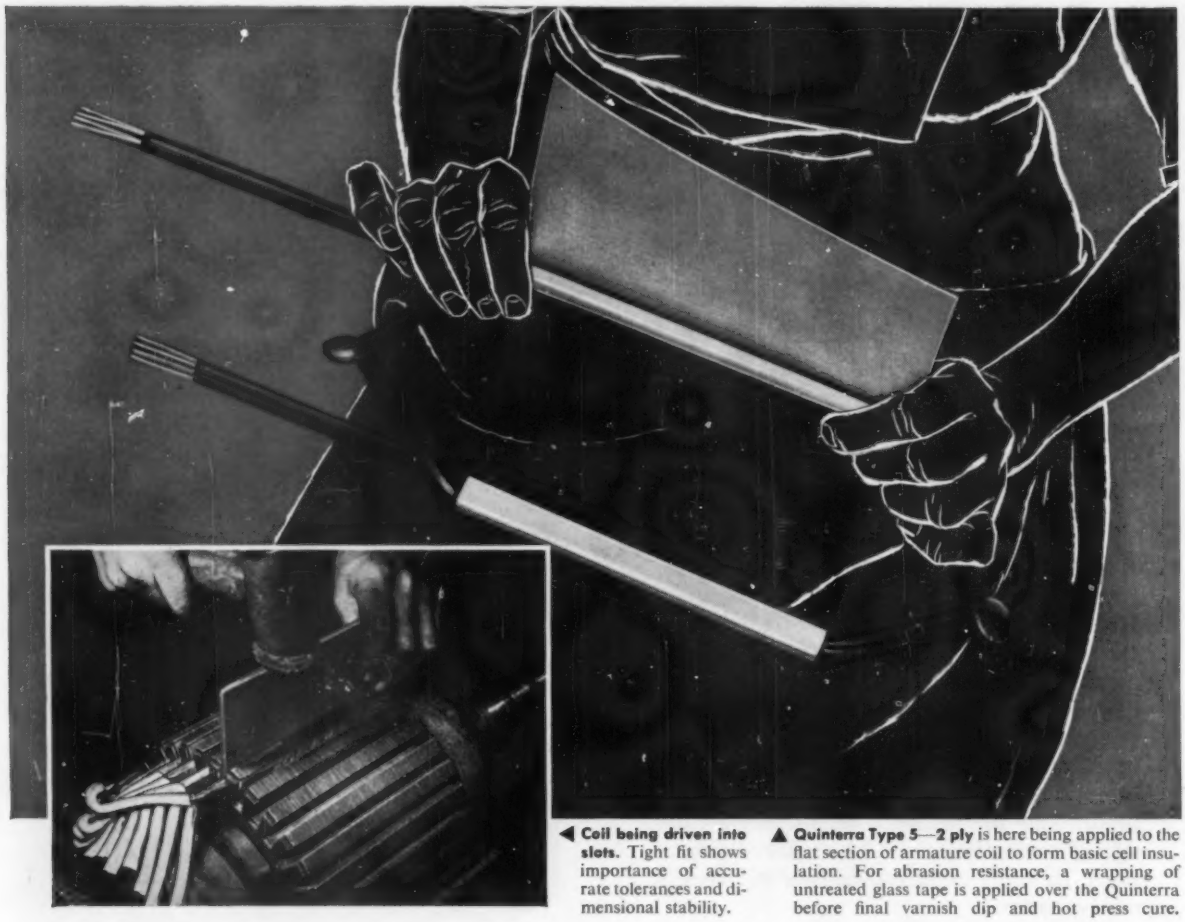


Best of all, there is no increase in cost in ratings 10 kva and below, single phase, and 30 kva and below, three phase. A slight increase in cost of higher ratings is more than offset by the many new advantages.

The tank is simple and sturdy — it has four formed corners and only one welded seam. The bottom plate is recessed and held to the case by bolts for quick removal. The coil is given maximum protection with expensive Class H insulating materials. The unit is designed for 150 C rise. The result is a convenient, compact transformer that will give years of satisfactory operating life.

For more information call your nearby Allis-Chalmers distributor or district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4529

ALLIS-CHALMERS



◀ **Coil being driven into slots.** Tight fit shows importance of accurate tolerances and dimensional stability.

▲ **Quinterra Type 5—2 ply** is here being applied to the flat section of armature coil to form basic cell insulation. For abrasion resistance, a wrapping of untreated glass tape is applied over the Quinterra before final varnish dip and hot press cure.

Why West Virginia Armature Co. switched to J-M QUINTERRA® for armature coil insulation

West Virginia Armature Co., Bluefield, W. Va., is a leading manufacturer of motor armature coils, used by the coal mining industry—a severe and difficult field. It was only after 4 years of field testing that they decided to change to Johns-Manville Quinterra Type 5—2 ply for their traditional built-up insulation materials. They made this change because they discovered that:

1 Quinterra retains higher inherent dielectric strength under prolonged high temperature operating conditions.

2 Quinterra, manufactured to closer thickness tolerances, permits more accurately dimensioned coils, assuring easy and proper fit.

3 Quinterra is pliable, conforms readily to shape of coil and remains dimensionally stable in storage or in use.

4 Quinterra is smooth, does not crack or flake, is easy and pleasant to handle, does not harm or irritate operators' hands.

5 Quinterra is flexible, eliminates dielectric failures due to flaking or splitting.

Quinterra Type 5—2 ply is made from two sheets of highly purified asbestos treated with a polyvinyl acetate resin saturant and combined under controlled temperature and pressure. It has ample mechanical strength for easy handling. Its inherent dielectric strength exceeds 280 VPM even at temperatures over 130 C.

Find out how you can obtain the same benefits from Quinterra. Write for free 32 page illustrated brochure, EL-40A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

Dimensional accuracy is imperative. Here, finished coils are being tested in Go-or-No-Go gauge.

Johns-Manville ELECTRICAL INSULATIONS

Practical Methods

Split-Grouping Balances Stadium Lighting

LIGHTING

The addition of a major-league floodlighting system to the Kansas City Municipal Stadium (home of the Kansas City Athletics) provided another example of an electrical contractor's ingenuity in solving post-design installation problems. Basic electrical specifications called for 956 1500-watt floodlights to be grouped in eight locations. Four 150-ft outfield towers carry 100 fixtures each. Of four infield racks on the grandstand, two carry 100 fixtures each and two carry 200 fixtures each. A 3-phase, 4-wire, 7640/13,200-volt primary system distributes power to each tower and rack where one single-phase transformer (according to original specifications) serves the units in that specific bank. Secondary circuits to the fixtures were kept as short as possible. The complete electrical system was installed by Boese-Hilburn Electric Company, Kansas City, Mo.

According to John D. Hilburn, president of Boese-Hilburn, his engineers uncovered a major problem during preparation of the initial bid. That was electrically balancing the eight light towers equally on the 3-phase, 4-wire primary system. Since spacing, grouping, location and number of fixtures were definitely established by the manufacturer's engineers, physical rearrangement of units to attain phase-load balance was impossible.

The B-H solution was the *electrical* division of the 200-unit banks on the roof into two sections, one section being twice the size (in total watts) of the other in the bank. Thus two-thirds of the fixtures in a 200-lamp bank were connected to each phase. Addition of two small transformers took care of the other one-third of the lamps in the two banks. Connection of these transformers to the "light" phase of the primary system resulted in maximum electrical balance.

The lighting transformers are connected between phase and ground on the 7640/13,200-volt, 3-phase, 4-wire primary system. Primary leads are encased in conduit for the entire run; potheads are used on all cable terminals; the neutral wire is bare.

Each primary circuit consists of a 13.2-kv, grounded-neutral, oil base neoprene, shielded conductor and one bare wire common to more than one phase in a single conduit. Primary circuits terminate at transformer locations in a two-conductor pothead with each line wire equipped with a lightning arrestor and drop-out cut-out. A remote-controlled oil switch controls each primary feeder. No secondary switching is used.

For the most part, secondary circuits are short runs of triple-braid, weatherproof open wiring at the fixture racks. Horizontal secondary runs serve double rows of lamps.

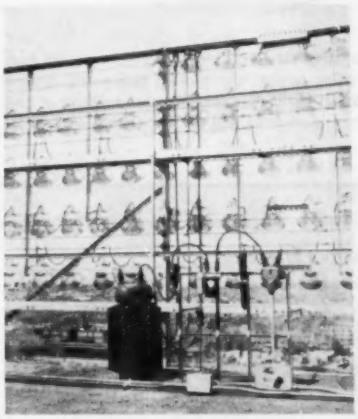
Each outfield light tower is fabricated of steel sections forming a 6-ft square untapered column. Crossarms forming the fixture support are on 3-ft spacing. Floodlights are mounted on 2-ft centers. A steel grille catwalk with guard rails provides access to each two rows of units.

Floodlights on the roof racks were set as they were installed. Tower banks were completely assembled at ground. The racks were fastened to the top section of the tower, fixtures mounted to cross-arms, aimed and completely wired. The 100-fixture assembly was raised into position and bolted to the tower. Secondary feeders then were installed to the transformer location.

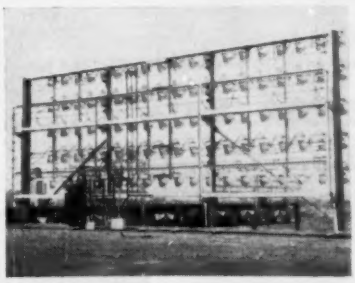
Control of the entire lighting system is concentrated in a conveniently located 2-ft square enclosed panel showing the stadium layout.

The floodlighting system is reported to exceed, by 30%, the required 150 footcandles in the infield and 100 footcandles in the outfield.

INFIELD FLOODLIGHTS are grouped into four banks on grandstand roof. Two racks have about 100 fixtures each; the other two about 200 units each. Electrical division of each large group into two sections with addition of a small transformer provides maximum load balance on feeders.



PRIMARY FEEDERS terminate in potheads at transformer location. Circuit has lightning arrestor, drop-out cutout and remote-controlled oil switch for switching entire bank of lights. Open-wiring secondary circuits serve fixtures.



ROOF BANK of 100 floodlights as seen from rear. Steel grille catwalks provide access to each two rows of fixtures for maintenance and relamping. Pushbutton in control panel operates entire bank.

Your choice of normal or low starting current...

with Performance-Rated

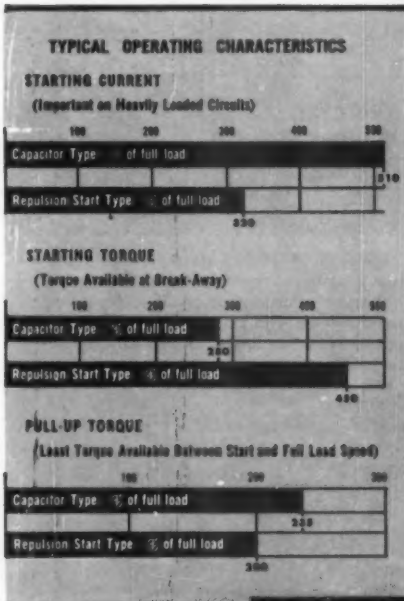
Century

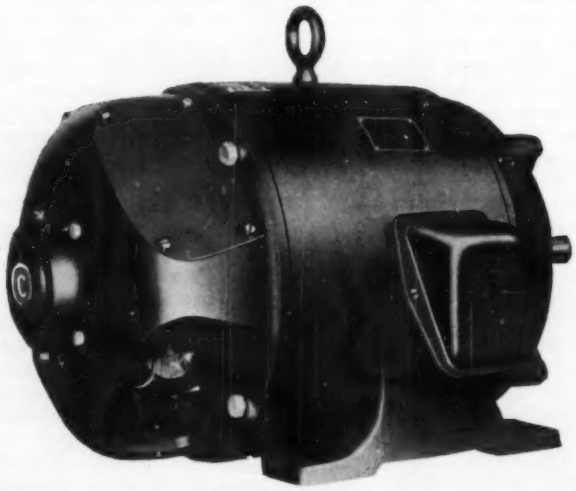
HIGH TORQUE, SINGLE-PHASE MOTORS

Capacitor Motors... ⅛ to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

Whatever Your Motor Job . . . there's a Century Motor Performance-Rated to handle it with top effectiveness. Contact your nearby Century branch office or Authorized Distributor.





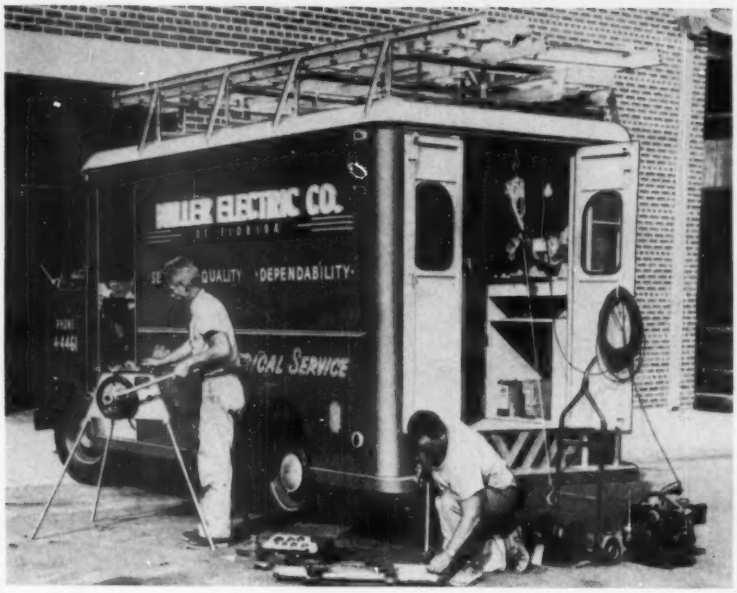
Repulsion Start, Induction Motors (type RS)... ½ to 7½ H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated® Motors ⅛ to 400 H. P.

CENTURY ELECTRIC COMPANY

CE-32

1806 Pine Street, St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*



Contractor Uses Mobile Shops

JOB MANAGEMENT

Everything needed for any electrical repair or installation rides to the job in Jacksonville, Fla. The Miller Electric Company of Florida, provides its growing list of customers with finer and faster electrical service work, thanks to its large fleet of specially equipped mobile electrical shops. The truck body is made of hi-tensile steel to withstand the high corrosion rate encountered in this area, as well as the hard use the trucks are exposed to. These bodies were designed and built by the Boyertown Auto Body Works of Boyertown, Pa.

Miller's truck fleet provides complete electrical service to residential, commercial, industrial, manufacturing, utility and marine establishments. Each truck is equipped with a self-contained lighting and power system to use when regular power is off or not obtainable. A complete line of power tools is carried in racks and bins in the truck—everything from motor-operated hack saws, keyhole saws and electric punches to machinery for hydraulic threading and bending of conduit. These tools are from 3 to 25 times faster than the usual hand methods.

Complete acetylene welding and cutting equipment is carried, along with a full complement of electrical parts and materials. These are kept in space-saving compartments built into the actual truck body wall. Such an arrangement, Miller Electric finds, keeps tools and parts out of the weather to which they would be exposed in open pick-up trucks.

A large quantity of electrical testing equipment is also carried—voltmeters, ammeters, ohmmeters, circuit power analyzers and insulation testers. Each truck is equipped with 2-way radio for emergency service calls. All these time-saving tools and ideas speed each job, enabling Miller Electric to deliver its services at lower cost.

Mobile Conduit Bender Has Gas-Driven Power Unit

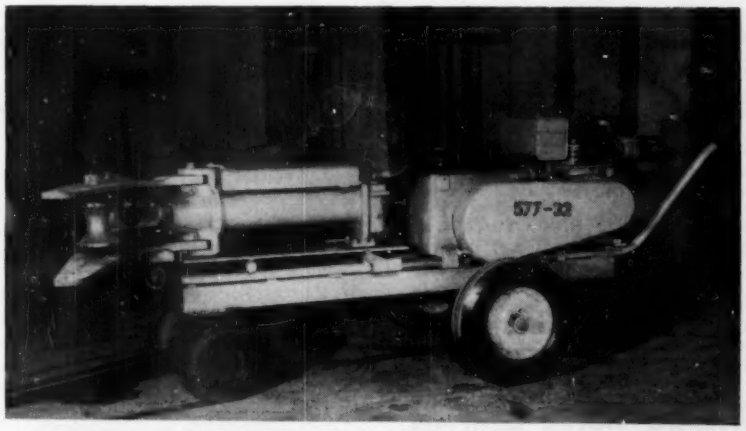
MAINTENANCE

One of the prime functions of an electrical maintenance department is to get work done as quickly as possible so production can be resumed with an absolute minimum of delay. Thus it is important to have power tools and power equipment available to the maintenance electrician. Frequently, that is not enough. Such equipment must be mobile so it can be moved from place to place in the shortest possible time and with the least amount of effort. This is particularly true in today's modern one-story plants where a single building may cover acres of floor space.

This is the basic operating philosophy of the electrical maintenance department at the Boeing Airplane Company plant in Wichita, Kansas. Tools and equipment are tailored to their specific needs. A gasoline-driven, mobile, hydraulic power bender is an example of the type of equipment they use and modify to attain this goal. The heavy-duty power bender is mounted on a pneumatically tired 4-wheel steel carriage to provide the mobility. A gasoline engine operates the hydraulic motor on the unit so it can be used anywhere, even if there is no electric current or circuit available. This is an especially handy feature if work has to be done during a power outage or shutdown. And the bender is at a convenient working height for handling heavy conduit.

In addition to operating the bender, the gasoline-driven power unit can be quickly disconnected and used to power various other types of hydraulic equipment used at the plant.

This combination of features, including simple maintenance, is responsible for substantial savings in electric maintenance at the Boeing plant. The unit is in use on an average of about six hours per working day. A time study revealed that electrical crews could bend conduit 60% faster with this mobile, hydraulic bender than previously was possible when it was manually operated.



MOTORIZED HYDRAULIC conduit bender is mounted on a pneumatically-tired carriage at convenient working height. Gasoline-driven hydraulic power unit can be quickly disconnected and used on other hydraulic tools and equipment used by Boeing maintenance electricians.

Now . . . Diesel Plants, Too!

"Packaged Electric Power"

UNIVERSAL ELECTRIC PLANTS

Simplified, Sized Right

Size and weight are down—output is up with new Universal Electric Plants. For example, this compact 4-cylinder, air-cooled model delivers 10,000 watts—all voltages available.

For permanent installation or portable service, Universal gives you a wider choice of modern models. Here are favorites for all purposes with a full range of emergency-standby electric plants. You name the controls—we can deliver. From manual starting through all types to fully automatic. These plants are built to your needs, controls included.

More sizes—both air-cooled and water-cooled—insure you the correct money-saving model. Capacities up to 25 k.w., AC and DC—1, 2, 4, and 6 cylinders. Diesel models to 35 k.w. All are backed up by one of the oldest names in the electric plant industry. We have produced continuously since 1914 . . . have been in the engine business since 1898.

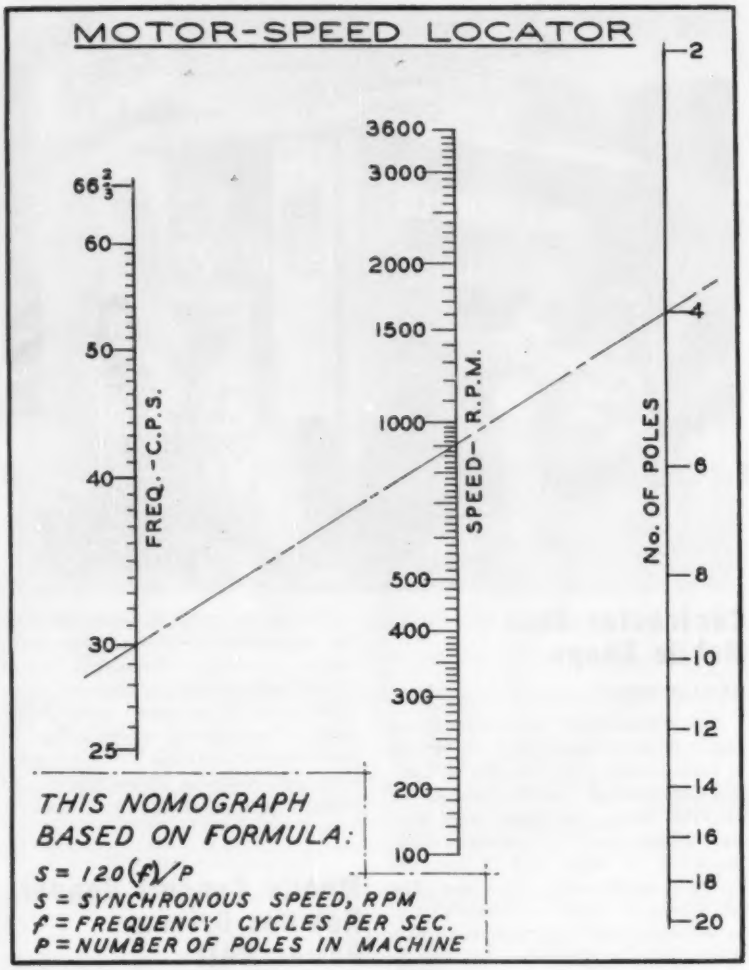
See how we can serve you better

Helpful guide of all Universal air-cooled models plus facts on water-cooled series mailed on request. Write today for this and list showing low Universal prices.

UNIVERSAL MOTOR COMPANY

438 UNIVERSAL DRIVE
OSHKOSH, WISCONSIN

ONE OF AMERICA'S LARGEST, OLDEST BUILDERS OF ELECTRIC PLANTS



Determining Speed of AC Machines

COMPUTATIONS

Most generators, motors, and other rotating equipment receiving or supplying alternating current, run at a fixed speed (magnetically), known as the synchronous speed, when no outside control regulates or changes the characteristics of the current or frequency. In actual practice there is a certain amount of slip which reduces the unit's speed to a value somewhat below the synchronous speed—generally about 2% to 3% at no load, and 5% to 8% at full load. This applies only to induction apparatus—not true synchronous machines. Also, there are instances when the synchronous speed must be determined for equipment with a certain number of poles operating at various frequencies. The accompanying chart submitted by Ralph R. Taggs, electrical engineer of Jackson, Mich., is a great help in such computations.

EXAMPLE: What is the synchronous speed of a 4-pole induction motor operating from a 30-cycle current (30 cps)?

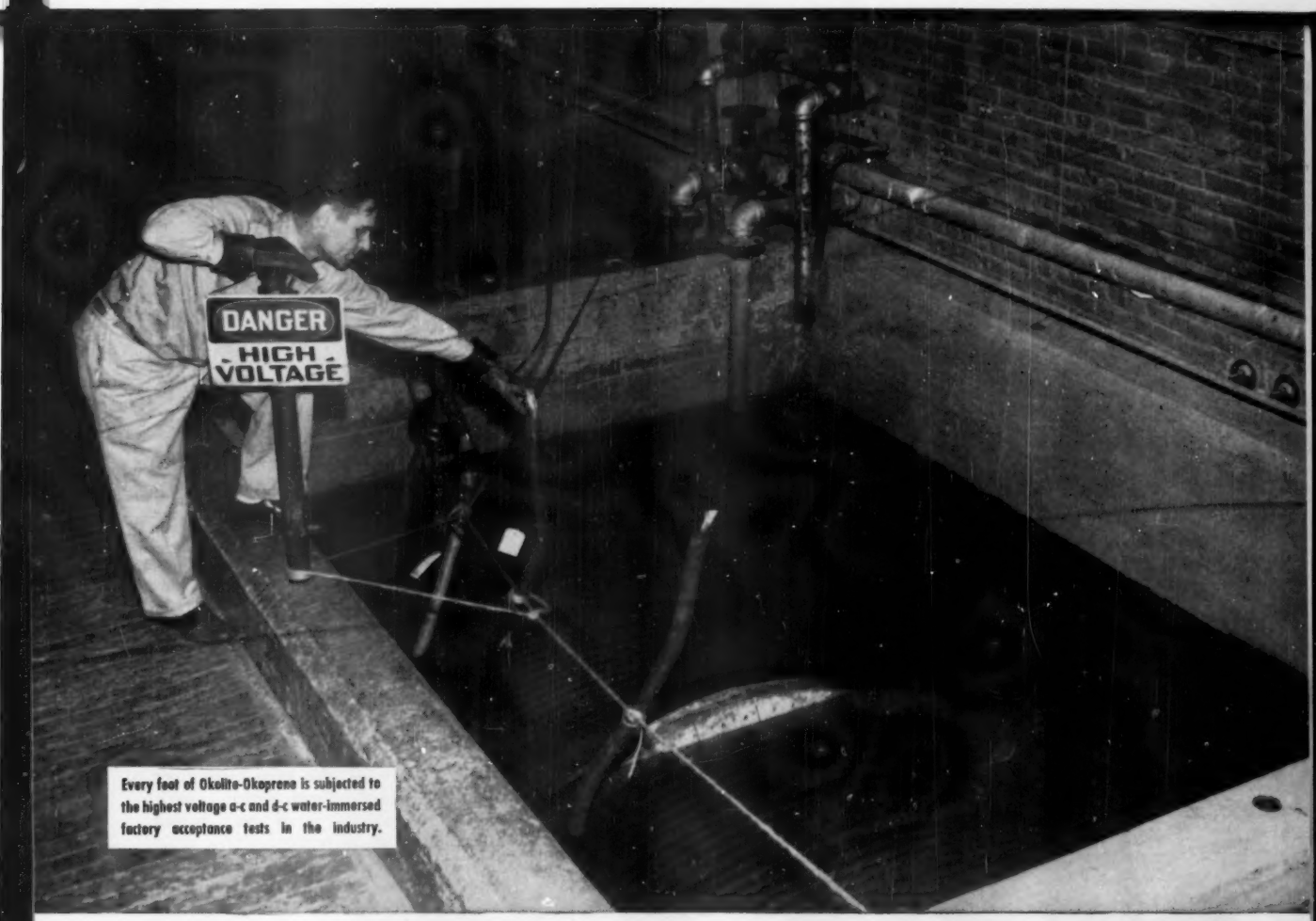
SOLUTION: Place a straight-edge from 30 on the "Frequency-cps" column to the figure 4 on the "No. of Poles" column at the right of the chart. At the intersection with the middle scale may be read the synchronous speed of the motor: 900 rpm.

Note that this chart has been set up for the common power frequencies met in utility and industrial plants today. Though 60 cycle current is most conventional, 25, 30, 40, 50, and 66⅔ cycles also are met, both here and abroad.

Plug-in Pedestal For Temporary Power

CONSTRUCTION

Installation and maintenance of temporary power facilities during construction of an 18-story apartment building in Seattle, Wash., was the responsibility of the project electrical contractor, Salmon Bay Electric Company of Seattle. The contractor



Every foot of Okolite-Okoprene is subjected to the highest voltage a-c and d-c water-immersed factory acceptance tests in the industry.

why Okonite cables last longer

Field service is the only true test of a cable's worth. And one case history after another shows that Okonite cables have given years of outage-free operation under the most difficult conditions. Premium materials and careful manufacturing methods have helped build this record. But materials and methods alone do not make dependable cable. Built into every Okonite construction are two all-important extras: research and quality control.

Take quality control. One man out of every six at Okonite is engaged in testing. During each phase of production, Okolite-Okoprene cables are inspected and tested to make certain they meet Okonite's standards. The following list of quality controls are not generally used by other cable manufacturers, but are *always* used at Okonite. Many of these controls are distinctive Okonite developments.

1. **The use of the strip-insulating process, which applies a series of insulating strips of controlled thickness, insures a uniform wall of insulation and sheath.**
2. **Every foot of cable is subjected to the highest voltage a-c and d-c water-immersed factory acceptance tests in the industry.**
3. **Each batch of insulating and sheathing compound must meet a series of tests before it is applied to the conductor.**
4. **Foot-by-foot electrical testing and inspection of the insulation and sheath is carried on both before and during application to the conductor.**
5. **Okolite-Okoprene cables are always vulcanized in a metal mold to obtain maximum density and uniformity.**

Service records prove beyond a doubt that these Okonite control methods result in dependable, longer-lived cables. The Okonite Company, Passaic, N.J.

Available with either copper or aluminum conductors

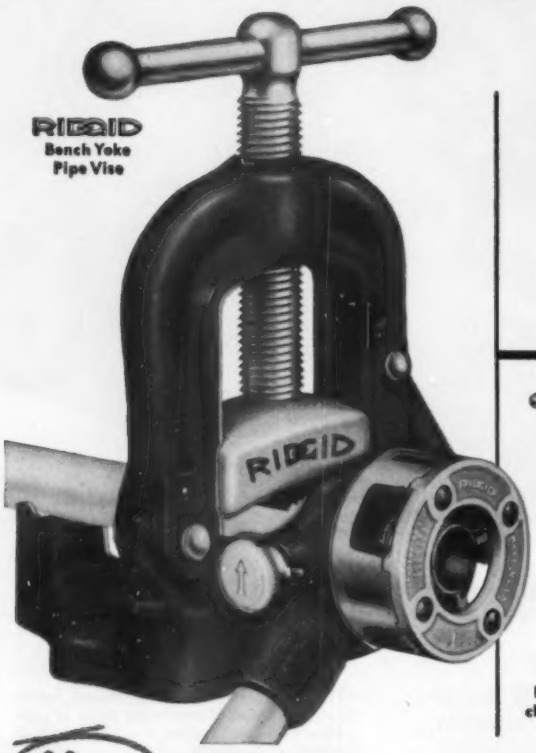
OKONITE OKONITE SINCE 1878 ***insulated cables***

2892

You get *More* for your money when it's a work-saver

RIDGID

Bench, Kit or Post Conduit Vise

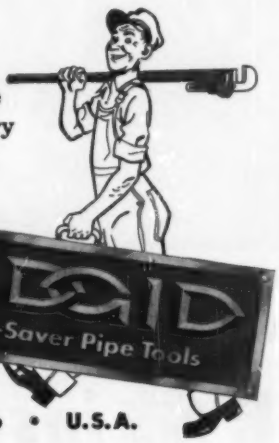


RIDGID
Bench Chain Pipe Vise

RIDGID
Kit Pipe Vise, portable, clamps on bench or plank

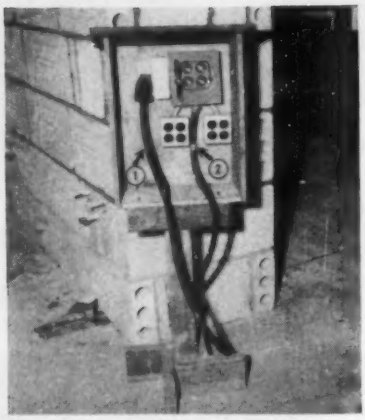
More efficiency... specially designed jaws that grip firmly . . . close and open fast . . . conduit rests for more accurate threading, easy cutting . . . handy conduit benders.

More service... famous RIDGID heat-treated jaws for extra long wear . . . special malleable frames that won't warp or break . . . every vise factory tested to assure you super-performance and durability.



Get most for your money—buy RIDGID Vises, including stand and tristand, at your Supply House!

The Ridge Tool Company • Elyria, Ohio • U.S.A.



TEMPORARY POWER PEDESTAL features plug-in, sectionalized riser cables. Feeder No. 1 plugs into standard range receptacle and extends riser to similar power pedestal on floor above. Feeder No. 2, for panel shown, plugs into pedestal on floor below. Technique permits progressive extension of temporary power system as multi-story building rises to full height. Four-circuit fuse box protects four, duplex twist-lock receptacles for extension cords.

had to provide the necessary riser cables and tap-offs with outlets at each floor for the use of all other trades as well as his own men.

Salmon Bay Electric's approach to the problem was one of installation and maintenance ease, flexibility and safety of use, plus quick removal after the building was completed. Salvability of equipment for possible reuse on other jobs was also a prime consideration. All of these features were included in a power pedestal system with sectionalized riser cables developed for this project.

Key to installation ease and flexibility was the power pedestal unit. The power panel assembly consisted of a four-circuit fuse box feeding four duplex 3-wire, grounded, twist-lock receptacles. Each receptacle was protected by a 20-amp fuse. The fuse box was fed by a No. 6, 3-conductor, 110/220-volt, non-metallic sheathed riser cable of sufficient length to plug into a temporary power pedestal on the floor below. Connection was by means of a 50-amp range plug and receptacle. A standard range receptacle mounted to the side of the fuse box provided plug-in facilities for the feeder section to the temporary power panel on the floor above. The complete assembly was mounted in an open-face wood enclosure supported by a 4-in. by 4-in. wood pedestal held upright by four 2-in. by 6-in. wood "feet".

With this method, temporary power facilities could be expanded progressively—floor by floor—as the building rose to its full height. On-the-

You can pull these plugs at full load . . . SAFELY!

Circuit-Breaking Arktite

PLUGS AND RECEPTACLES

20 amp. to 400 amp.—250V D.C.; 600V A.C.

SAFE at all times—even if you pull an *Arktite* plug to disconnect an energized motor or appliance in an emergency!

You don't have to open the disconnect switch before withdrawing an *Arktite*. Arcs created as line and load poles disengage are confined in deep, insulated arcing chambers—are instantly snuffed out by pressure-deionization and lack of oxygen. There's no possible danger of flashover injuring personnel or destroying property.

Contact your Crouse-Hinds Distributor, nearest Crouse-Hinds Office or Representative for complete information.

NEW, Re-Designed *Arktites*...

Feature new pressure connectors — new easier-to-wire 1-piece interior assemblies — new easier-to-interchange plug and receptacle interiors — new plug adaptability to any type and size cable.

Fully interchangeable with older style. Same price. Currently available in 30 and 60 amp. sizes, in 2-, 3- and 4-poles.

● **Operated like a giant switchboard, this *Arktite* installation with variations in power, frequencies and voltages is used to speed up machine tool testing. Plugs can be inserted and withdrawn from "live" receptacles without using a disconnect switch.**

A NATIONWIDE DISTRIBUTION exclusively through ELECTRICAL DISTRIBUTORS

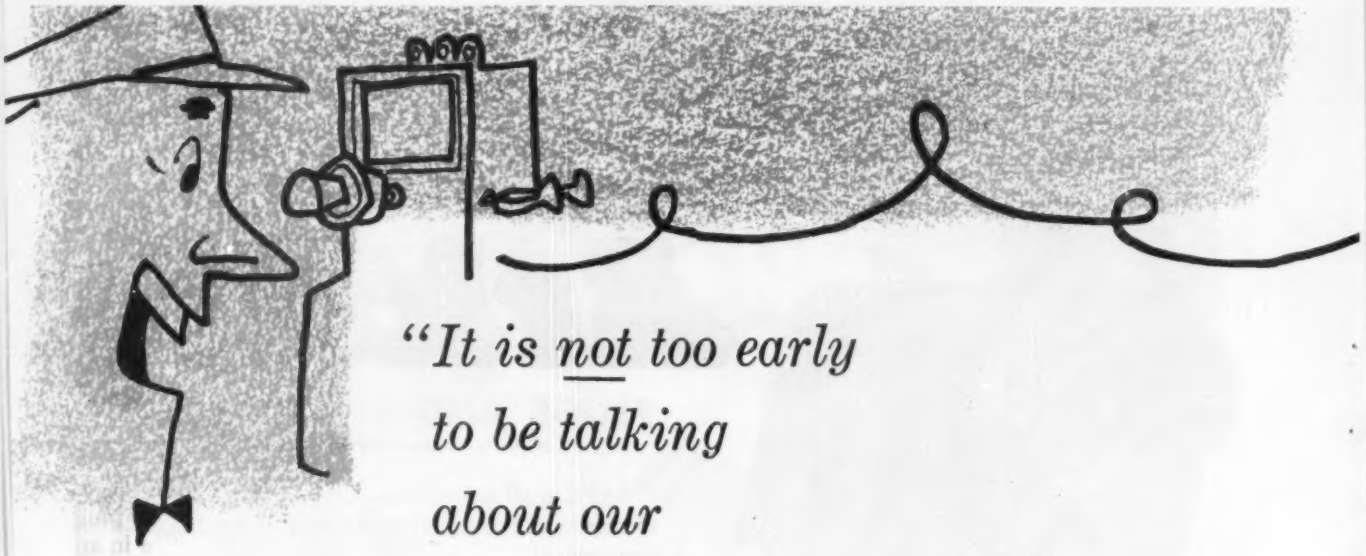
CROUSE-HINDS COMPANY

SYRACUSE 1, N. Y.

OFFICES Birmingham Boston Buffalo Chicago Cincinnati Cleveland Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Memphis Milwaukee New Orleans New York Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul San Francisco Seattle Tulsa Washington RESIDENT REPRESENTATIVES Albany Atlanta Baltimore Baton Rouge Charlotte Chattanooga Corpus Christi Reading, Pa. Richmond, Va. Shreveport

Crouse-Hinds Company of Canada, Ltd. Toronto, Ont.

CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING



"It is not too early to be talking about our May '56 issue!"

"The *Modern Electrical Design Issue* of ELECTRICAL CONSTRUCTION AND MAINTENANCE in May '56, will be the most complete issue of its kind ever published...

"It will give electrical men up-to-the-minute information on designing electrical systems, big and small, for power, light, heat, communication and signals...

"It will describe efficient modern designs for distribution systems, utilization circuits and utilization equipment—for industrial, commercial, institutional jobs, and for special interiors...

"It will supply data on the selection and application of devices and equipment used in modern electrical systems..."

PRACTICAL, EASY-TO-USE

We'd like you to know well in advance about this truly outstanding presentation.... The May 1956 issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE will offer its readers an 80-page report (enough material to fill a 200-page textbook) ... on Modern Electrical System Design.

Planning an electrical system for a hospital operating room, a school, an industrial research lab, the electrical man can turn to the May issue for models of up-to-the-minute design. Liberal use of tables, and diagrams of typical installations will make the information easy to understand and use.

To make sure the newest design information is included, this outline of the *Modern Electrical Design Issue* will undergo changes and modifications up to the last minute before publication. However, the outline will serve to give you an idea of the issue's vast scope. Months of work are going into its preparation.

1. *General considerations in wiring design*—Capacity . . . regulation . . . accessibility . . . flexibility . . . safety . . . cost.

2. *Basic wiring systems*—Utilization voltage systems . . . distribution voltage systems . . . primary and secondary networks.

3. *Industrial plant practice*—Typical high voltage systems . . . typical utilization voltage systems . . . control systems . . . signal and communications systems.

4. *Office and commercial building practice*—Typical systems . . . communication . . . provisions for tenant changes.

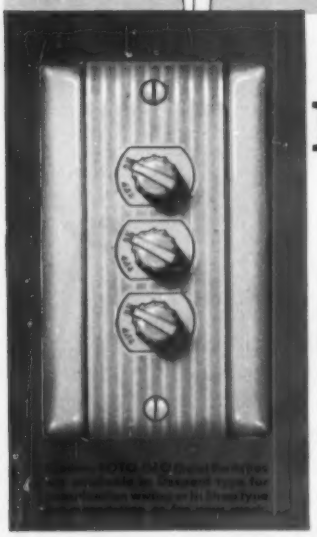
5. *School buildings*—System layouts . . . auditorium and stage lighting . . . special electrical facilities . . . classroom wiring.

6. *Hospital and Institutional buildings*—Typical systems . . . special electrical facilities such as room systems . . . nurse call, doctor call and paging systems . . . emergency light and power systems.

7. *Hotels and motels* – Apartment buildings . . . miscellaneous projects . . . lighting systems . . . electric space heating systems.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

A McGRAW-HILL PUBLICATION,
330 WEST 42ND STREET, NEW YORK 36, N. Y.



PROVEN PROFITABLE

IN THE FIELD

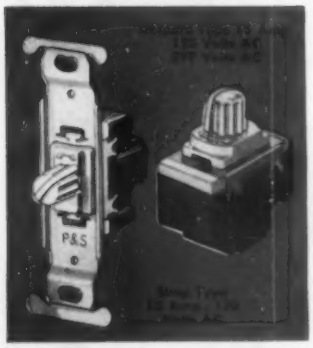
ROTO-GLO®

quiet switch

In home project installations ROTO-GLO switches have proven themselves to be profitable time and again in two important ways. In addition to cutting installation time and costs, smart appearing ROTO-GLO switches with their modern performance features, also make homes easier to sell.

ROTO-GLO switches are the part of the wiring job that home buyers see. They put in a good word for the quality of behind-the-wall wiring materials and workmanship. ROTO-GLO is fast becoming the "customer preferred" switch of home conscious America.

Here is a partial list of home projects where ROTO-GLO switches have been profitably used and praised by the builders themselves:



- East Ridge Homes & East Borough Subdivision, Lincoln, Nebraska
- Brookside Subdivision, Dearborn Township, Dearborn, Michigan
- Wedgewood Homes, Kansas City, Mo.
- Belvidere Heights Project, Kansas City, Mo.
- Terrace Lake Gardens, Kansas City, Mo.
- Joe Maroney Housing Project, Denver, Colo.
- Ray Mar Motel, Rochester, Minn.
- Thunderbird Inn & Restaurant, Oklahoma City, Okla.

Try them yourself! Your first installation will show you how ROTO-GLO Quiet Switches cut installation costs and help the builder sell homes faster and easier. Send today for complete information on the ROTO-GLO Quiet Switch and for a folder on modern Despard wiring devices, to Dept. ECM-6.

P&S

PASS & SEYMOUR, INC.

Syracuse 9, New York

71 Murray St., New York 7, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill.

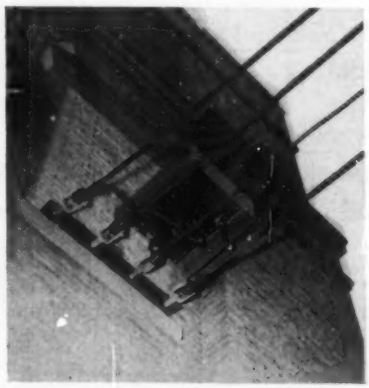
In Canada: Renfrew Elec. & Refrig. Co., Ltd., Renfrew, Ontario

job labor require to extend the riser was held to a minimum. An assembled power pedestal was placed on the new floor; the feeder cable was dropped down a pipe shaft and plugged into the pedestal on the floor below.

The sectionalized feeder system did not interfere with the masonry trades. Pipe shafts were boxed in while the risers were in use. A small opening at the base of the wall was left to pull out the feeder and extension cables when the project was completed.

A total of 40 power pedestals, with their plug-in sectionalized feeder cables, were used on this project. In general, there were two per floor located at the pipe shaft in each wing of the building. All were 100% salvable. Dismantling the system merely involved unplugging the sectionalized feeders, pulling the cables out of the shafts and coiling them up in the temporary power pedestal enclosure, ready for storage.

Too often, estimating the cost of providing temporary power on a construction project falls in the category of guessing and becomes a matter of gambling that the allotted figure will cover the work required. Development of an organized technique, such as that used by Salmon Bay Electric, places this phase of the work on a predictable basis. Material costs are known. Experienced labor costs are established. With the sectionalized plug-in feeders, unit installation and dismantling costs per power pedestal can be used much the same as unit costs per foot of conduit.



RAIN CAP PROTECTS new 1,600-amp, 3-phase, 4-wire, 120/208-volt, bus duct service entrance at Manchester Biscuit Company in Fargo, N. D. Galvanized sheet steel metal enclosure is flange mounted to bricked-in window area through which duct protrudes. Service drop cables are looped around dead-end insulators and held by U-bolt clamp, then continue up to solderless lugs on bus extensions. Each insulator clevis is supported by angle-iron bracket mounted to wall with through-bolts. Installed by Dakota Electric Construction Company.

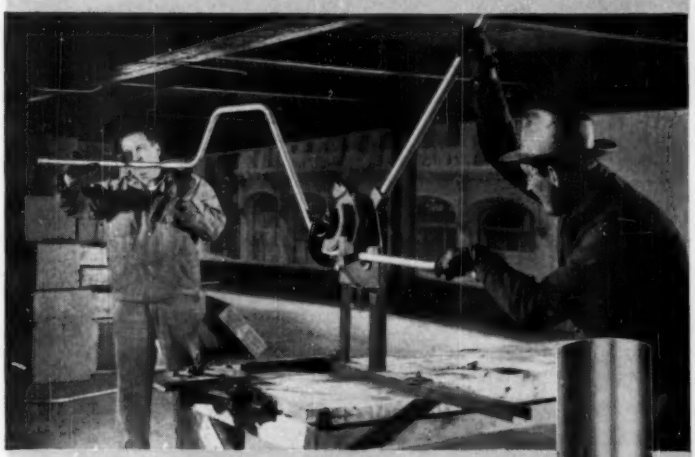
SPANG® CONDUIT

—easy bending qualities aid construction of 3 public parking garages

The easy bending qualities of Spang Conduit were put to the test in the construction of three public parking garages where construction plans required tricky bends around columns and beams. But, from all three construction sites the electrical construction crews reported fast, trouble-free conduit installations with SPANG HD (Hot-Dipped, Heavy-Duty) Galvanized Conduit.

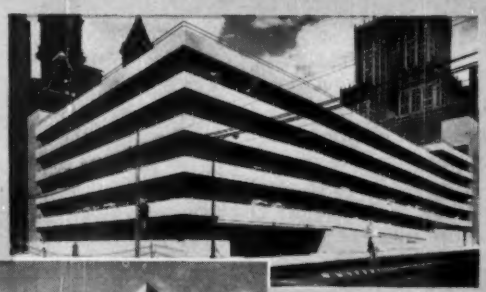
That's because of SPANG'S *quality-control* manufacturing which produces a uniform product every time. There are no hard spots to create bending problems, breaks or splits. And SPANG HD's uniform galvanized and lacquered finish does not chip, flake or peel even under the most severe bending strains.

Let SPANG be your first choice for all conduit installations. Contact your nearest SPANG Distributor for *top-quality* service.



PITTSBURGH: Allies Garage, Boulevard of the Allies and Smithfield Street. Six levels, 528 spaces. Designed as a giant ramp with half of each floor sloping down, other half sloping up. Motorist can park his car on any level. Two self-service elevators serve all levels. SPANG HD Galvanized Conduit is installed along columns and ceilings for lighting and elevators. Cost: $741,000. In operation July, 1955.

Owner: Pittsburgh Parking Authority
Architect: Hoffman & Crumpton
Contractor: Ragnar Benson, Inc.
Electrical Contractor: Fischbach and Moore, Incorporated
Spang Distributor: Keps Electric

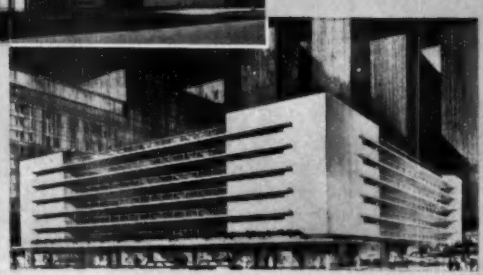


CHICAGO: Parking Facilities No. 1, 11 West Wacker Drive. Fourteen levels, 717 spaces. World's largest mechanical parking garage. Served by five Bowser System automobile elevators which travel horizontally as well as vertically within the shaft. SPANG HD Galvanized Conduit is imbedded in concrete, serving elevators, intricate controls and lighting. Cost: $1,665,557. In operation February, 1955.

Owner: City of Chicago
Architect: Shaw, Metz & Dolio
Contractor: Herlihy Mid-Continent Co.
Electrical Contractor: Knott & Mielly
Spang Distributor: Effengee Electric Supply Company

PITTSBURGH: Diamond Street Garage, Diamond and Smithfield Streets. Seven levels, 864 spaces. Conventional design for service in retail shopping center of Downtown Pittsburgh. Three self-service elevators. Includes seven first-floor stores facing on Smithfield Street. All SPANG HD Galvanized Conduit runs imbedded in concrete supply service to stores, elevators and general lighting. Cost: $1,395,000. In operation November, 1955.

Owner: Pittsburgh Parking Authority
Architect: Hoffman & Crumpton
Contractor: United Construction Company
Electrical Contractor: Fischbach and Moore, Incorporated
Spang Distributor: Keps Electric



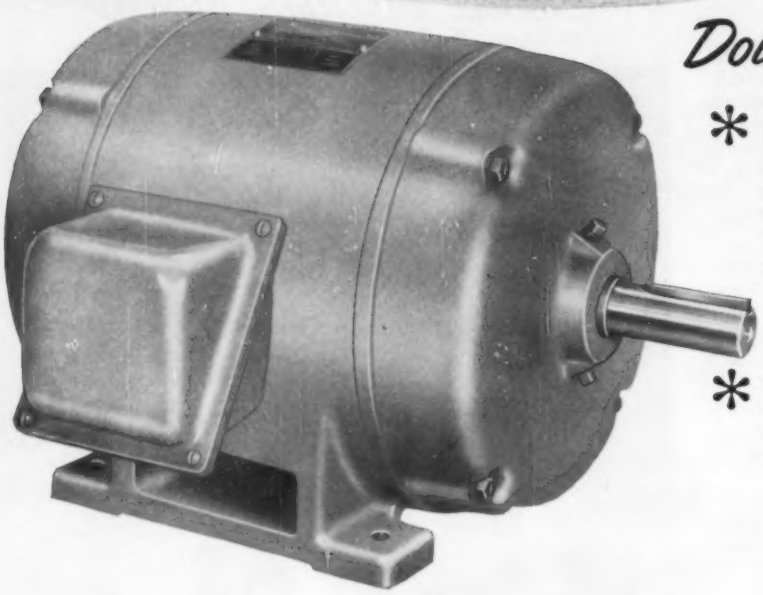
SPANG® CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
TWO GATEWAY CENTER, PITTSBURGH, PA.
District Offices and Sales Representatives in Principal Cities

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

NEW!
Wagner Type *DP** Motors

Doubly Protected



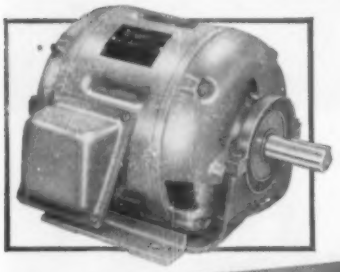
* Wagner Type DP Motors are protected by rugged, corrosion-resistant cast iron frames, smoothly rounded so that no moisture can collect on them. Motor feet are cast as an integral part of the frame for maximum strength and rigidity.

* Enclosures are drip-proof plus! Air intakes are located at the bottom of the endplates — air outlets are located at the base of the frame, one on each side. Specially designed baffles provide protection for the stator windings.

The Wagner line of polyphase, drip-proof general purpose motors—rerated to the new NEMA Standards—pack more power into smaller frames, but give you the same high Wagner Quality and long life performance that have made Wagner Motors "the choice of leaders in industry" for many, many years. These new Wagner Motors are fully protected in the ball bearing models. Their construction makes them completely drip-proof — and virtually splash-proof. The extra large, diagonally split conduit box makes wiring easy. Smaller size and lighter weight means more economical handling and installation.

These new rerated Wagner Motors retain the features desired by plant engineers and maintenance men. They will operate for years without regreasing. But . . . when lubrication *is* necessary or desirable, you *can* lubricate these motors because they are provided with two lubrication openings.

Bulletin MU-202 gives full information—write for your copy today.



AVAILABLE WITH RESILIENT MOUNTING —SLEEVE BEARINGS UP THROUGH 5 HP.

These Wagner standard motors, in ratings up through 5 horsepower, can be used for specialized applications because they are available in sleeve bearing models with endplates that will take resilient mounts.

You can look to Wagner for a complete line of standard motors for specialized applications. The wide range of types and sizes permit the selection of a standard motor for almost any need.

Wagner Electric Corporation EST. 1891

Wagner Electric Corporation
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

M55-6

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

Motor Shops

Peg Board Keeps Bench Tools in Order

A well organized work area contributes substantially to overall operating efficiency, whether it be in a mass-production industry or in a motor repair shop. Seemingly endless searching for tools, materials or parts can add up to a surprising amount of lost time at the end of a day or week. Such a situation can put a crimp in the production curve of any shop.

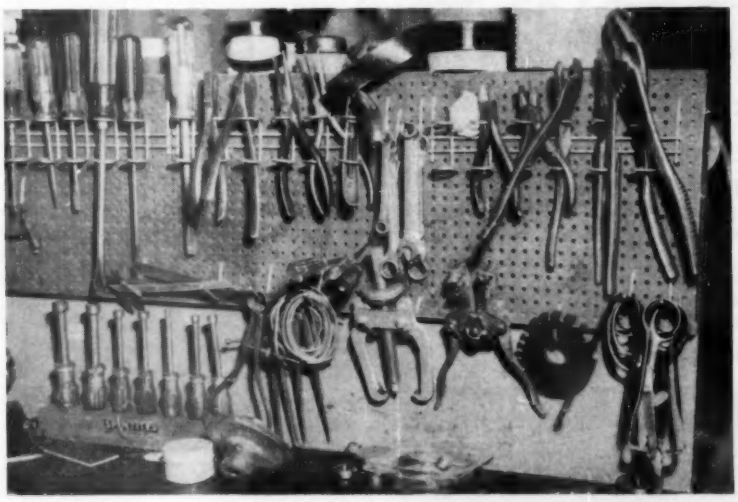
Management at Industrial Electric Co., Seattle, Wash., has been aware of this fact for some time and constantly encourages employees to offer better "housekeeping" suggestions for its motor repair division. The net result is a well-run, clean, shop operation.

New ideas run the gamut from small to large improvements. One of these was the addition of peg-board tool racks to the work benches. Now each bench is equipped with a 48-in. by 10-in. section of peg board mounted on a spacer frame to a 16-in. high backboard added to the bench. Each board tilts slightly away from the front of the bench. Conventional peg-board wire racks hold the variety of hand tools used in motor repair work. Arrangement of racks can be easily changed to suit the needs of the individual mechanic.

No longer need mechanics search through crowded bench drawers or tool boxes to find a specific wrench, pliers, screwdriver, calipers, wire stripper, or other hand tool. All are neatly racked in front of them in plain sight and within easy reach.

Both management and the mechanics like the new arrangement. They agree that it saves time and adds to the appearance of the repair shop.

PEG BOARDS on back-to-back work benches keep hand tools in orderly fashion and within easy reach. Mechanic can find and grasp specific tools in seconds.



WIRE RACKS hook into holes in peg board; support variety of tool items. Rack arrangement can be quickly changed to suit individual mechanics.

Separate Room for Insulation Storage

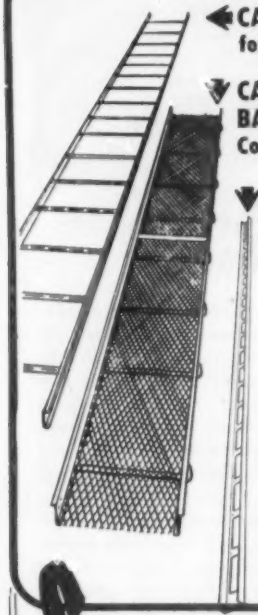
Finding the proper type of insulation for a motor repair job is a simple chore at the Buzzell Electric Works shop in San Francisco. All types and sizes of insulating materials are kept in a separate room that can be kept clean and free from the dirt and grime that may settle over the general shop area.

Easy-to-reach storage facilities are confined to one 16-ft-long wall in the room. A combination of base cabinets and pigeon-hole shelves accommodate everything from flat sheets, sleeving and rolls to tape and spools of banding wire. Tops of the base cabinets are 35½ in. above floor level and the shelves extend up another 62 in. to the ceiling.

One section of the base cabinet is specially designed for sheet insulation and contains 36 wide, shallow drawers. Each drawer is 40 in. wide, 1½ in. high, 22 in. deep, and has a metal card frame for content identification. The adjacent section, designed for sleeving, slot wedges and similar items, extends an additional 15½ in. out from the wall and contains 36 drawers in four horizontal rows. Each drawer is 5¾ in. wide, 5½ in. high and 38 in. deep. Sleeving drawers are frequently taken from the insulation room to the mechanic's bench in the shop. This practice assures return of all odd pieces and prevents a mix up of sizes when returning insulation to storage.

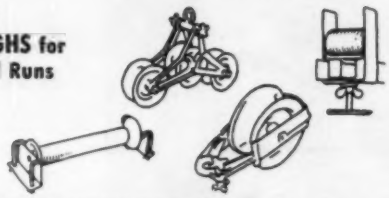
ALUMINUM
OR GALVANIZED STEEL
SUPPORT SYSTEMS
FOR POWER AND CONTROL CABLES
IN-FREE-AIR
DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

A SINGLE SOURCE OF SUPPLY
FOR A SYSTEM
Complete to the Last Bolt



CABLE RACKS for Power Circuits
CABLE BASKETS for Control Circuits
CABLE TROUGHS for Limited Runs

LONG SPAN SUPPORTS for Bridging Applications



INSTALLATION TOOLS for fast cable "pulls"

PLUS over 1,000 items of accessory hardware including:

hanger clips	suspension fittings
hanger rods	wall brackets
support channels	cable clamps
pipe spacers	cable banding
concrete inserts	insulator blocks

Lowest Ultimate Installed Cost
THRU SAVINGS IN FIELD ERECTION

- LIGHTWEIGHT ALUMINUM—faster installation
- LONG SPANS—fewer supports
- LONG LENGTHS—fewer splices
- HEAVY LOAD CAPACITY—fewer runs

★

Design and layout assistance available
Unit responsibility assumed
Over 2,000 completed installations—Send for catalog.

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.
5300 VINE STREET, CINCINNATI 17, OHIO

SHEET INSULATION of mica, fiber or other types, is stored and protected in this bank of 36 large, shallow drawers comprising one section of a base cabinet.

TROUGH-LIKE DRAWERS for insulated sleeving, slot wedges and similar items make up other base section. Drawers can be removed from cabinet and taken to mechanic's bench.

Wall shelving above one section contains 25 pigeon-hole spaces, each 14 in. wide, 12 in. high and 11½ in. deep. These, plus 30 similar units above the sleeving cabinet, contain rolls of tape, binding twine, spools of banding and lead wire, solder and other miscellaneous items. Between the two shelf sections is a 50-in. wide open space with six slotted, wood brackets designed to hold 12 rolls of insulating paper on pipe spindles.

Immediately under the roll insulation rack and attached to the front edge of the cabinet top is a 50-in. long strip of wood with a cutting slot. Fastened to the cabinet top, on 8-in. long, hinged arms, is a 50-in. length of 1-in. by ¼-in. flat steel bar. When lowered over insulating paper on the

A report
from George Pappas,
Chief Engineer,
N. Y. Transformer Co., Inc.,
Alpha, N. J.

"During my twenty-five years of experience with radio and TV transformers," reports Mr. Pappas, "I have found no cost-cutting contribution that can equal General Electric's new Permafil 73515. With this new insulating varnish, we at N. Y. Transformer have been able to pioneer special impregnating techniques which reduce lamination weight 25%, copper weight 15%, and cut cure times in half. Our new, smaller transformers operate more reliably at higher temperatures than our old line impregnated with conventional insulating varnish."

Where can YOU SAVE with Permafil 73515?

The superior heat dissipation of Permafil 73515 (it lowered operating temperatures 25°C for N.Y. Transformer) may help *you* redesign for substantial cost savings. Properly used, it is ideal for impregnating coils in vibrating power tools, FHP stators, and high-voltage transformers and magnet coils. It yields void-free insulation that eliminates corona, increases heat dissipation, and provides relatively constant power factor over a wide range of voltages and temperatures.

SEND COUPON FOR TECHNICAL REPORT!

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Company
Chemical Materials Department
Section 512-38, 77 River Road
Schenectady 5, N.Y.

Please send me a technical report and product data sheet on G-E Permafil 73515.

Name_____

Firm_____

Street_____

City_____ Zone____ State_____

COOLING VENTILATION

— that's easy on the budget!
— that's quiet and trouble-free!
— that improves working conditions!

"Buffalo"

DESIGN 53 PACKAGE PROPELLER FANS

- **EASY TO PICK THE RIGHT SIZE!** Complete selection includes 5,000 to 250,000 cfm capacities.
- **EASY TO INSTALL!** Shipped to you as ready-to-run "packages". Can be inexpensively mounted in window or wall openings.
- **PERFORMANCE MEETS TEST CODES** of A. S. H. V. E., N. A. F. M., P. F. M. A. and U. S. Commercial Standard CS-178.
- **HIGHLY EFFICIENT** — small horsepower requirements for high air delivery.
- **SATISFACTION ASSURED** — the "Buffalo" "Q" Factor* of Quality built into every fan. Backed by 78 years of fan leadership.
- **WRITE FOR BULLETIN FM-315** — see how quickly, easily and inexpensively your plant can be enjoying this healthful ventilation!

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

BUFFALO FORGE COMPANY
520 BROADWAY BUFFALO, N. Y.
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS "E" BLOWERS-EXHAUSTERS

ROLL INSULATION is racked between wall shelves and cut on the spot with the aid of a hinged, steel guide and retention bar. Brackets hold 12 rolls of insulating paper.

PIGEON-HOLE SHELVES on both sides of roll rack hold such items as tape, rolled sleeving, solder, lacing cord, binding twine and spools of lead wire and banding wire.

work surface, this bar lines up with the cutting strip and acts as a straight edge and retention bar for cutting roll insulation. Normal practice is to unroll the selected insulation to the desired width, slide it under the retention bar and over the cutting strip, then cut it with a sharp knife.

On the opposite side of the room, under the window area, is a long work bench for the normal complement of insulation processing equipment including creaser, edger and floor-operated cutting shear. With this arrangement, passage to and from the storage facilities does not interfere with operation of the equipment.

According to Buzzell shop superintendent A. N. Schwindt, keeping the insulation inventory in a separate, conveniently located room of this type has worked out exceptionally well. Mechanics know where to look for specific items. Unused material is returned to the proper storage place. The resultant economy in material and time has contributed substantially to maintenance of top efficiency.

Only 90 seconds to change barrels

Easy change from one stud size to the other right on the job!

Here's the only tool you need for all stud fastenings

New Double-Duty

REMINGTON STUD DRIVER

Sets both ¼" and ⅜" studs in steel or concrete—in seconds!

Light-, medium- or heavy-duty fastening, the new Model 455 Remington Stud Driver speeds the job. It sets *two* different size studs... up to 6 studs per minute, either size . . . and offers new possibilities in anchoring conduit clips, steel frames, wood forms and many other fixtures.

Powerful 22 and 32 caliber cartridges drive ¼" and ⅜" studs *solidly* into steel or concrete. For special medium-duty work, the smaller cartridge is used with the larger stud. Result: the greatest flexibility ever in a cartridge-powered tool! Just clip coupon for details.

"If It's Remington—It's Right!"

Remington DUPONT

MAIL THIS COUPON TODAY

Industrial Sales Division
Remington Arms Co., Inc., Bridgeport 2, Conn.

Please send me your free booklet which shows where and how to use the cost-saving Remington Stud Driver fastening method.

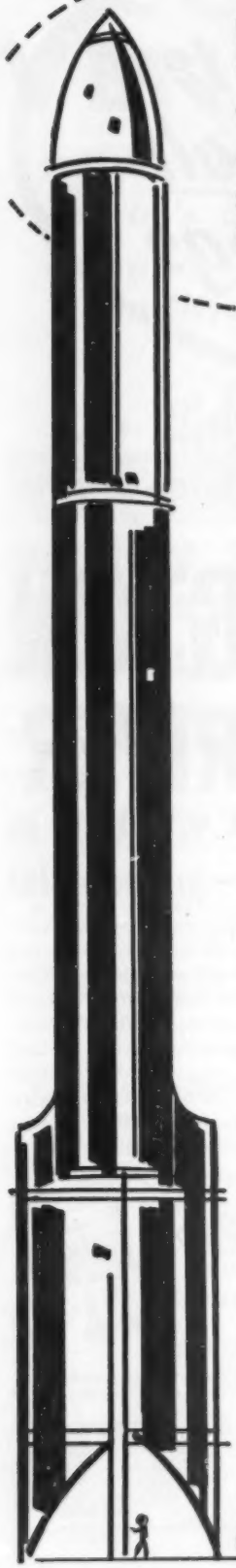
*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

E.C.M.-12



Even for the special "out of this world" wiring problem . . . a down-to-earth solution — Continental Wire

Whether it's a rocket to the moon or a radio for a room—chances are you'll find Continental ready to serve your wiring needs exactly—with both speed and efficiency.

With many quality insulations of Asbestos . . . Glass . . . Nylon . . . Varnished Cambric . . . Polyethylene . . . Polyvinyl . . . Teflon . . . Zytel, among others, Continental also offers a wide range of wire sizes—in stock and on special order. For instance, Continental's ELECTRONIC HOOK-UP WIRE. This nylon-insulated, hook-up wire saves TIME . . . LABOR . . . and GUESS-WORK in assembly. Resistance to abrasion, acids, alkalis and petroleum solvents—and temperatures ranging from —50° C to +125° C —assures dependability plus versatility. Available in AWG SIZES 18 to 32.

One source for your many wiring requirements —Continental. Write today for Continental's complete catalog of heat-resistant, moisture-resistant wires, cables and cords. Serving 600-5000 volts. Sizes, 18 AWG—2,000,000 CM.

Continental's industrial wire and cable specialists are available to serve you at any time.

Contact: Continental Sales, Box 363, Dept. CW
Wallingford, Conn., Phone COlony 9-7718

Continental
WIRE CORPORATION
WALLINGFORD, CONNECTICUT • YORK, PENNSYLVANIA

Vacuum Clears Dust From Sanding Disc

Sanding of slot wedges created a certain amount of wood dust in the shop of the Industrial Electric Company of York, Pa., until a standard tank-type vacuum cleaner was adapted to suck this annoying dust away from the sanding disc. As shown in the accompanying photograph, the tank of the cleaner is supported beneath the sanding wheel on the shelf of the motor frame, and the hose is taped to one of the legs; the suction nozzle being positioned close to the under side of the bed plate. As the sanding wheel rotates, the dust is pulled instantly into this suction head, resulting in improved shop cleanliness, atmospheric purity and better dispositions. Simple in idea and in arrangement, the method has been highly recommended by Industrial's shop foreman Dave Miller.

Bench-Side Test Board Speeds Motor Repairs

Flexible and compact testing boards are mounted on the wall alongside each work bench in the motor service department of the L & P Electric Construction Corp. of Brooklyn, N. Y. Without leaving their benches, shop workers can obtain several different voltages of either ac or dc with or without resistances in the line by merely making the proper arrangements of the double-throw knife switches at the lower portion of the board.

For testing dc equipment, the mechanic sets the top three single pole double throw switches in one of the positions described on the etched plastic nameplate at the center of the

NEW BULLDOG *Electrostrip*

PATENTED

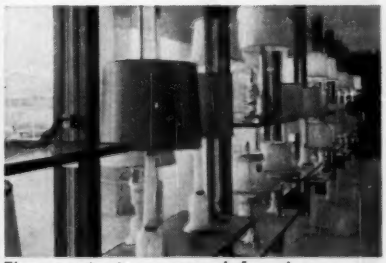
PROVIDES MOVABLE ELECTRICAL OUTLETS . . .

At last! Here's an electrical product that keeps pace with changing needs . . . one that provides outlets that can be moved in seconds—placed and spaced exactly where they are needed, as they are needed. It's BullDog Electrostrip® and it's as perfect for modernization as it is ideal for new construction. The strip is neat, attractive . . . *completely safe*. Listed by Underwriters' Laboratories. Rated at 20 amps., 125 volts, A.C.

IN HOMES, HOTELS, OFFICES, STORES, INSTITUTIONS!

Receptacle plugs twist into Electrostrip at any spot along its length—make it *every inch an outlet*. The strip's ivory color blends perfectly with any color scheme. Individually fused plugs are also available.

Electrostrip mounts on walls, partitions, baseboards, anywhere . . . bends around obstructions and corners. Outlets can be easily moved as furniture or office layouts demand. No dangerous extension cords.



Electrostrip is a natural for showrooms and shops. Displays can be changed and arranged to best advantage for outlets are always handy...always where needed. To add another outlet, add another plug.

Sold *only* to electrical contractors through BullDog distributors. See yours, or write BullDog Electric Products Company, Detroit 32, Michigan.

IF IT'S NEW . . . IF IT'S DIFFERENT . . . IF IT'S BETTER . . . IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A Division of I-T-E Circuit Breaker Company

Export Division: **13 East 40th Street, New York 16, New York.** ***In Canada:*** **BullDog Electric Products Company (Canada), Ltd., 80 Clayson Road, Toronto 15, Ontario.**

© BEPCO

FULLMAN **Latrobe**
Electrical Products

Floor Boxes and Wiring Specialties

ADJUSTABLE WATERTIGHT FLOOR BOXES
•
NON-ADJUSTABLE WATERTIGHT FLOOR BOXES
•
ADJUSTABLE GANG FLOOR BOXES 1-2-3 AND 4
•
FLOOR JUNCTION BOXES

FULLMAN MANUFACTURING CO. QUALITY A LATROBE O SUPREMACY LATROBE, PA.

COMPACT—ECONOMICAL

"Latrobe" Floor Boxes and Wiring Specialties are designed for quick, easy installation and superior performance. Stripped of frills and complex assembly, "Latrobe" Products do their job smoothly and economically.

Non-Adjustable Watertight Floor Box

Unique, practical design cuts installation time; makes safer job and leaves more wire space inside box. Cover Plate is 3½" diameter.

Adjustable Floor Box

Designed for telephone outlet or where permanent connections are made, or as a junction box. All adjustable boxes are fireproof.

Insulator Supports

Fasten porcelain or glass insulators to steel framework without punching holes. 3 sizes—1", 1½", 2" and 2½".

Keystone Fish Wire

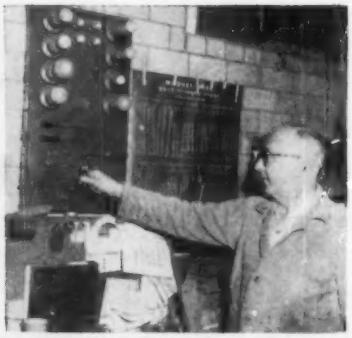
Ten sizes — for lightest work to heaviest power wiring. 100, 150, and 200 foot coils.

We are equipped to design and furnish special requirements on short notice. Send your blueprints or rough sketches.

Write for complete catalog and price list.

UTILITY OUTLETS
•
NOZZLES AND FLOOR BOX ACCESSORIES
•
INSULATOR SUPPORTS
•
PIPE AND CONDUIT HANGERS
•
ARMORED CABLE SUPPORTS
•
CABLE CLIPS
•
STAPLES
•
FISH WIRE

Fullman Manufacturing Co.
1209-1215 JEFFERSON STREET
LATROBE, PA.



SMALL MOTOR TESTING is simplified by accessible switchboards mounted at the side of each work bench. Double-throw knife switches permit shopmen to obtain several voltages of either dc or ac current. Lamps and heating elements at top can be put into the line to supply resistance or to check continuity.

board. Four dc connections are available: 110-volt, 220-volt, and either of these with resistance circuits in the line. Similarly, ac can be obtained at 120/240 volts single phase and 208 volts 3-phase, with or without resistance tie-ins.

Resistance elements consist of incandescent lamps of varying sizes and conical ceramic heating elements. Value of resistances is adjusted either by actuating the pull-chain switch on the lamp receptacle which holds these components or by changing the elements for units of the desired size.

Connections to the test boards are made by means of the several plug receptacles mounted flush into the bottom and side edges of the screw-cover steel cabinet. The receptacles are of varying styles so that any type of cord connector from the standard parallel blade cap to a 3-pole and ground Twist-Lok unit may be employed. For ordinary service, a 4-wire S cord is connected at the bottom of the box: this assembly is supplied with insulated test prongs at its other end.

Starting buttons on the sides of the boxes control the remotely located contactors for the 110-volt and 220-volt dc generators and also the air compressor which feeds the compressed air outlets in the shop. Aside from the standard ac and dc voltages mentioned above, shopmen may obtain other values by walking to the nearby master switchboard and adjusting the line resistance on the dc feeders or the motorized tap-changer on the ac shop service transformers.

L & P motor shop supervisor Fred Smith endorses this practice. By minimizing the frequency of the occasions for shopmen to leave their benches, working efficiency is stepped up and the likelihood of minor accidents is appreciably reduced.

Lady of Lourdes Hospital, Camden, New Jersey

IN HOSPITALS, TOO, IT'S *"Talk-Don't Walk"*

MODERN ARCHITECTURE—
MODERN INTER-COM SYSTEMS

Modern buildings of all types are wired for inter-com sound systems. Efficiency demands "Talk—Don't Walk."

The beautiful new Lady of Lourdes Hospital at Camden, New Jersey, has taken advantage of the permanence and trouble-free performance of Belden Inter-Com Cables for its built-in systems. Specifically, Belden No. 8743 is used for its under-pillow radio receivers.

There is a specialized Belden Cable for every inter-com or sound system requirement.

Belden Manufacturing Co., 4623-A W. Van Buren St., Chicago 44, Ill.

"Talk-Don't Walk"

For *Permanent* Installations

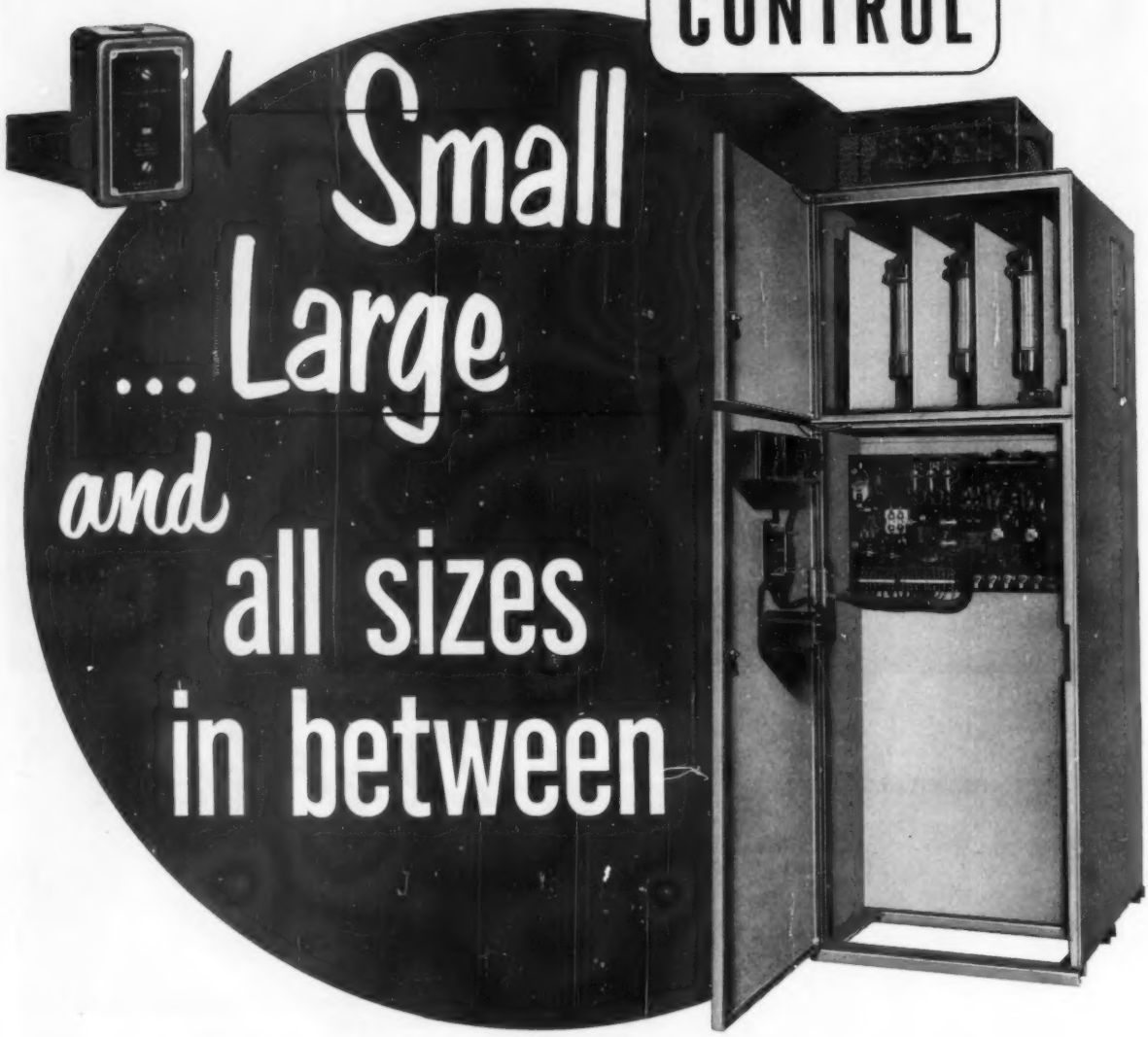
For Profitable Work

FOR EVERY TYPE OF INSTALLATION
FOR EVERY TYPE OF EQUIPMENT
BELDEN HAS THE CABLE BUILT TO
MANUFACTURERS' SPECIFICATIONS

Belden
Inter-com
CABLE

Allis-Chalmers offers a complete line of

MOTOR CONTROL



The Allis-Chalmers line extends from small manual starters for fractional horsepower motors through starters applied in controlling up to 2500-horsepower motors. Built into every control is the type and degree of protection required to meet your specific needs. Control functions, varying with application, include full or reduced voltage starting, acceleration, speed control, reversing or non-reversing, and dynamic braking.

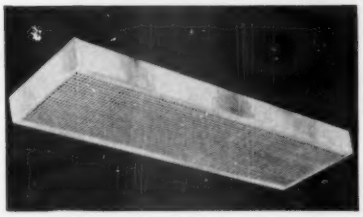
Application Help

An Allis-Chalmers recommendation is backed by the experience gained in solving thousands of control application problems . . . by complete research and testing facilities. Get all the facts. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4722

ALLIS-CHALMERS

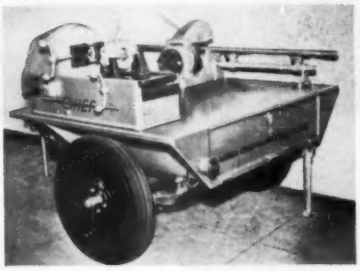
Product News



Fluorescent Fixture (1)

A new fluorescent lighting fixture, called "Surfacers", is designed to blend with contemporary interiors. Its shallow depth, thin lines give freedom in pattern planning. Units form any square or rectangle, T, U, L, H, or any design that is desired. They have steel sides, bottoms are ⅜-in. cube 45° by 45° Gratelite louvers in 11-in. or 16-in. full widths. They are available for 2-, 4- or 8-ft lamps, two or four lamps wide.

Edwin F. Guth Company, 2615 Washington Ave., St. Louis 3, Mo.



Trailer (2)

A new mobile trailer for use with E-Z cutter pipe and tubing cutter. The Chief also accommodates a portable generator, and has room to store hand tools so that operator has a complete workshop for construction and repair jobs in all locations. Trailer is work-bench height and of all-steel construction.

Gaines-Collins, 5474 Alhambra Ave., Los Angeles, Calif.

Aerial Cable (3)

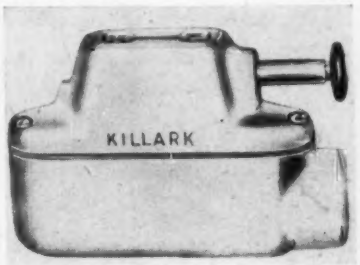
A "reverse-lay" preassembled aerial cable with Type AB butyl rubber insulation and neoprene jacket has been added to the Anaconda line. Conductors of the self-supporting cable are assembled in a series of reverse twists spaced at regular short intervals along the cable. This permits the lineman to untwist and separate the conductors at any point so that taps can be made easily. On non-shielded cable, taps can be made while the line is energized.

Anaconda Wire & Cable Company, 25 Broadway, New York, N. Y.

Voltage Tester (4)

A new current-limiting voltage tester has been introduced. Special current-limiting resistors, wire wound and ceramic insulated, are built into each test product of the new model 61-007. By limiting current in the leads to a maximum of 1 amp at 250 volts, the operator is protected from danger resulting from accidental shorts or breakdowns. Even with infinite-buss source, the arc drawn from a short at 250 volt-amps would not endanger either personnel or equipment.

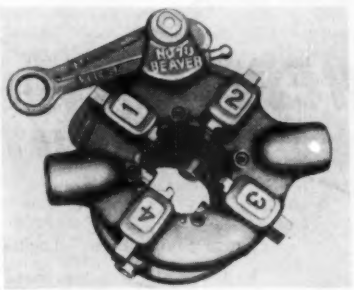
Ideal Industries, Inc., 1041 Park Ave., Sycamore, Ill.



Switch (5)

New non-rusting, aluminum toggle switches are small, with several styles of ½ in. conduit hubs. They are furnished wih a weatherproof cover and gasket. They are Underwriters' listed, and the switches supplied are "T" rated.

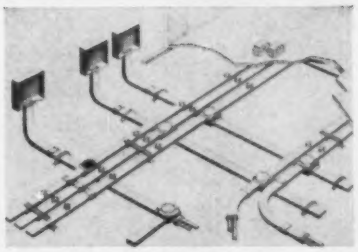
Killark Electric Mfg. Co., Vandeventer and Easton Aves., St. Louis, Mo.



Threader (6)

A new quick-opening Quadra-type threader for use with any power drive, called Beaver "78". It threads 1-in., 1¼-in., 1½-in., and 2-in. with only one set of full-width high speed dies, which is the same length as a perfect standard thread in the 1- to 2-in. range. Unit has a quick-opening die throw-out. When throw-out is opened, the dies retract. It can be set in any position — open or closed.

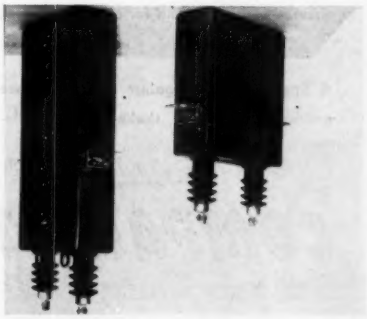
Beaver Pipe Tools, Inc., Warren, Ohio



Underfloor Wiring System (7)

A new two-level steel underfloor wiring system designed for commercial, industrial and institutional buildings. System consists of two levels of steel ducts with necessary fittings and is designed to feed and distribute power, telephone, signal and auxiliary systems. The lower level of duct is used to feed conductors from panel boxes to upper level which in turn distributes conductors to surface outlets. It provides for complete separation of high- and low-tension services. Separation is made possible because only single-duct junction boxes are used throughout. The box has duct entrances on two levels. This two-level design permits unobstructed runs without the necessity for special crossunders or crossovers.

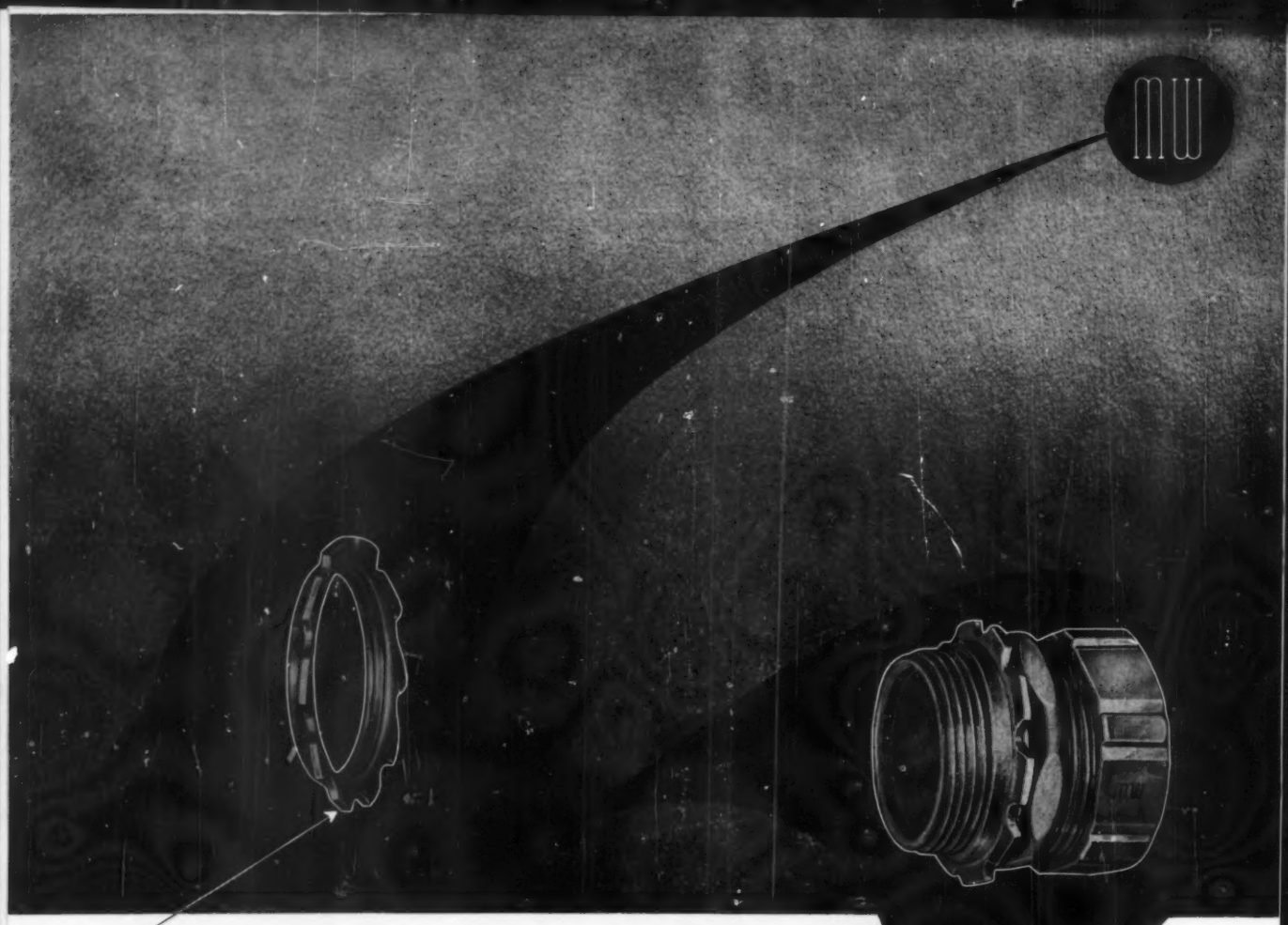
General Electric Co., Bridgeport 2, Conn.



Capacitor (8)

New 50-kvar power capacitor units, for all 60-cycle voltages from 2400 to 7960 volts are particularly applicable in locations where additional capacity has been required but deferred because of pole space limitations. They can be installed in NEMA standard 1-, 2-, and 4-unit hangers or in existing L-M single-row pole-mounted racks for 25-kvar units. They are impregnated with low-temperature Elemex suitable for operation from minus 40°C to plus 46°C. Units have steel tanks corrosion protected by aluminum metallizing process, a primer and an alkyd resin paint. They also incorporate solder-sealed bushings.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.



- Multiple locking edges for greater bond. Assures positive ground for electrical system.
- Spring tension against locking surface provides permanent shake-proof installation.
- Reverse bevel on inner surface permits bonding edges to be pulled up tight to locking surface.
- Up to 66% more driving notches for easier working angle, when tightening.
- Heavy gauge steel. Cadmium plated for corrosion protection.

COMPARE THESE midwest LOCKNUT FEATURES...

These "Sure Bond" Locknuts are specifically designed to do a better job. Compare these features against those of other types of locknuts. All Midwest fittings, 2" and smaller, come equipped with "Sure Bond" locknuts.

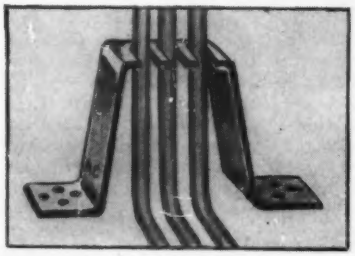
★ Here is another Midwest development in providing quality fittings. "Quality" is just a condensed way of saying: "Getting the total job done—right—with the most inexpensive combination of material and man hours." Engineering and producing quality fittings to meet the highest standards of electrical wiring installations, is our objective at Midwest.

Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET

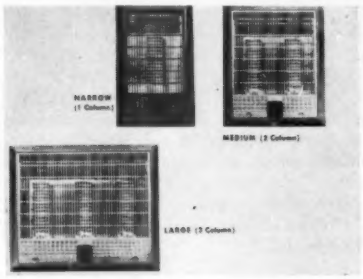
Chicago 12, Illinois



Box & Conduit Support (9)

New box and conduit support is recommended for use in thin wall and standard wall partitions, in all types of poured concrete construction. It is designed to keep conduit and boxes rigidly braced and lined up in the position specified while concrete is being poured. Support is available in two standard heights, with these specifications: Type RS45 is 1½-in. high with three ½-in. slots or two ¾-in. slots; Type RS60 is 6 in. high with three ½-in. or two ¾-in. slots. Made of 14 gauge galvanized steel. Literature is available.

Arrow Conduit & Fittings Corp., 129-30th St., Brooklyn 32, N. Y.



Electric Heat (10)

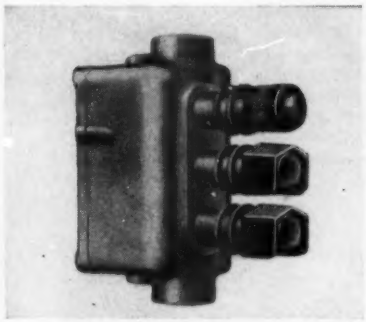
Two new lines of convection-type heaters and of electric cable are now being marketed under the trade names of Infra-air and Infracable respectively. The Infra-air convection-type heaters are available in three sizes and four styles—1-, 2- and 3-column, with two 1-column heaters for the smaller-type installations. The Infracable line consists of electric heating cable made of specially insulated wire. This cable is stapled to rock lath in a scientifically-determined pattern before plastering the ceiling. When plastering is completed, the entire radiant-system is invisible, except for thermostat.

Infraglass Heater Co., Inc., Pontiac, Mich.

Drive (11)

The new VS-100 drive is a wide-range adjustable-speed drive for machine tool feeds. Drive affords a speed range of 100:1 with continuous electrical speed adjustment. Capacity is from ½ to 4 hp. Drives are complete "packaged" drives with electronic control panels that are suitable for mounting and integrating with other machine controls. Drive motors are specifically designed for operation from the electronic control units. Sealpak construction is a feature of the control panels whereby all of the small electronic components are grouped, wired, and sealed in plastic for protection from atmospheres, vibration and shock. Operation of drive requires standard single-phase power.

Reliance Electric & Engineering Company, 1088 Ivanhoe Road, Cleveland 10, Ohio



Explosion-Proof Fixtures (12)

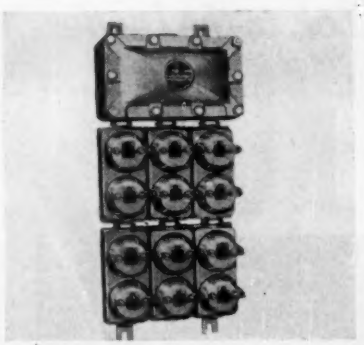
A new line of explosion-proof, dust-tight Condulets for flush panel mounting in hazardous locations. Type EMP Condulets combine explosion-proof construction with minimum panel space requirements. For mounting on panelboards up to 1½-in. thick, fixtures are secured to panels by locking nuts on threaded necks for pilot lights, switch handles or push-buttons. Condulet bodies in rear of panel are fitted with 1 in. through-feed conduit hubs and large flat ground covers to provide maximum access to interiors. Style 1 Type EMP Condulets are factory sealed for use with 125-volt pilot lights only, with one, two, or three lights, on 1⅝-in. centers. Style 2, requiring external seals, permit any desired combination of pilot lights, pushbuttons, and/or selector switches, one, two, or three-gang. Available with colored or clear glass jewels, 6-watt pilot lights can be furnished with transformers for circuit voltages higher than 110-125 in Style 2. Heavy duty, 600-watt pushbutton stations can be used singly for jogging service or in pairs for start-stop operations. Rotary selector switches, with switch handle for either vertical or horizontal mounting, are available with either two or three positions.

Crouse-Hinds Company, Syracuse 1, N. Y.

Cable Heating (13)

A new nylon-jacketed heating cable for plaster and dry wall construction. Its polyvinyl chloride insulation covered with a nylon coating is rated at a higher heat resistance and now carries UL approval for both types of construction. On dry wall construction, the new combination cable provides the desired wattage in shorter lengths. Completely color-coded by wattage in solid colors, the cable is provided on standardized reels of the same diameter.

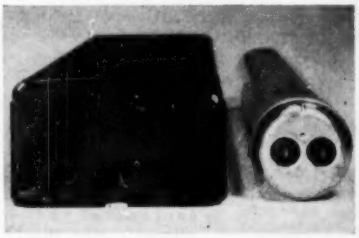
Sunwarm, Inc., Kingsport, Tenn.



Panelboards (14)

Especially developed both for hazardous locations and for installations where corrosive vapors, non-combustible dusts or moisture are present, these Type EWP panelboards with circuit breakers combine compact design with explosion-proof and dust-tight construction. These Condulet assemblies, functioning either as load centers or panelboards, provide circuit protection on wiring systems up to 120 volts. Completely accessible for connecting main and branch circuits on installation, all terminal blocks are located in the upper housing, which is available in two sizes. Smaller terminal block housing is used for panels with up to 12 single-pole circuit breakers (or six 2-pole breakers); the larger, for panels with up to 24 single-pole circuit breakers (or 12 2-pole breakers). Connections between circuit breakers and terminal blocks are factory wired. Circuit breaker housings, containing either two single-pole or one 2-pole breaker, are equipped with external operating handles, which can be padlocked in either the on or off position.

Crouse-Hinds Company, Wolf & Seventh North Sts., Syracuse 1, N. Y.



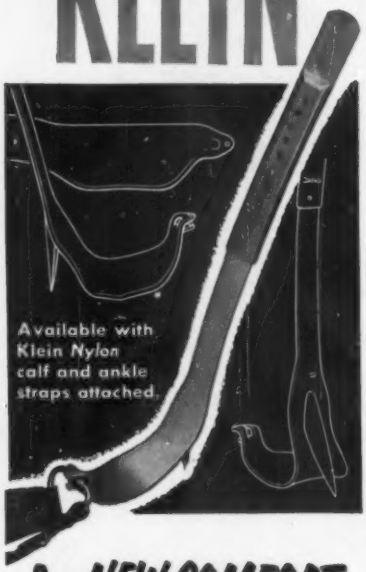
Ballast (15)

A new fluorescent lamp ballast designed for operation of two 8-ft or 6-ft fluorescent lamps. Ballast has been reduced in height by 27/32 in. to 1¼ in. There is a reduction in weight of approximately 10%, or one pound, over the model it supersedes. Designated catalog No. 89G596, it replaces No. 89G496. Ballast has a rating of 73 nominal lamp watts for operation of 8-ft lamps. It is a high power factor ballast designed for operation at 60 cycles, with a line current of 1.55 amps and a lamp current of .425 amps.

General Electric Co., Schenectady 5, N. Y.

Look to the Leader

KLEIN



for NEW COMFORT ...NEW SAFETY

Meet the big new favorite—Klein Climbers fully shaped to the contour of calf and ankle. That means a firmer, closer fit . . . a greater measure of safety. There's a new shape to the extra-wide stirrups also, for more comfortable arch support. Klein Climbers are made of forged steel, individually tempered and tested—aluminized for weather protection. Matched in pairs—adjustable length patterns 15 to 18 inches, specify 1945-ADJ—fixed length patterns 15 to 18½ inches, stock sizes specify 1945.

KG NO. 1 GAFF GAUGE
Keep this precision gauge handy for a safety check on proper spur shape. Plated steel—packed in durable plastic case.

1901-MG GAFF GUARDS
Protect the all-important spur of your climbers with this new Klein gaff guard. First quality leather with spring clip.

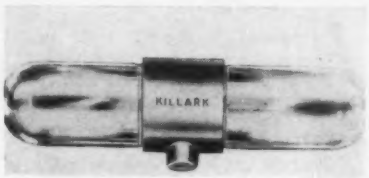
Instructions for sharpening gaff included.

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York.

Write for your free copy of the Klein Pocket Tool Guide today!

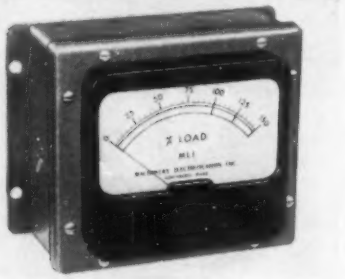
Mathias KLEIN & Sons
Established 1857 Chicago Ill. U.S.A.
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS



Vaporproof Fixture (16)

A new two-way cast aluminum vaporproof lighting fixture has been designed as an obstruction light or a 2-way light. It is ideal for use as an indicator light, a safety light, or a blinker. It is available in many colored globes; will take up to a 150-watt lamp on each side. It comes with a rigid ½ in. conduit hub. It is identified as VDG-110.

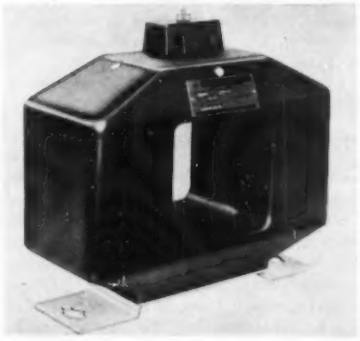
Killark Electric Mfg. Co., Vandeventer and Easton Aves., St. Louis, Mo.



Motor Load Indicator (17)

The MEK-2127 motor load indicator has been designed to offer easy to read scales calibrated in either percent load or hp with large color bands; highly damped instrument reduces needle waver from mechanical vibration or minor erratic load changes; conversion unit may be mounted near motor starter and light control wires can be connected to indicator. Dual voltage units are adjustable for operation on either 220- or 440-volt systems. Special scales can be supplied for any type motor or load.

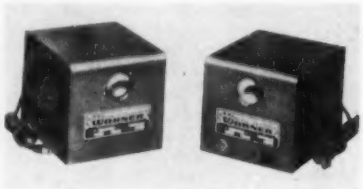
Machinery Electrification, Inc., Northboro, Mass.



Transformers (18)

A new line of thermo-setting epoxy resin cast indoor-outdoor current transformers designed for operating meters and instruments in single or 3-phase circuits up to and including 600 volts. Primary and secondary polarity markings are permanently molded into the transformer casing. Since secondary terminations are on top of transformer, it is possible to mount units close together. A short circuiting device, which requires no tools to operate, is incorporated into secondary terminal arrangement. Transformer can be mounted either vertically, horizontally or inverted. Transformer (Type BKM) is available in 1200, 1500, 2000, 3000, and 4000-amp ratings.

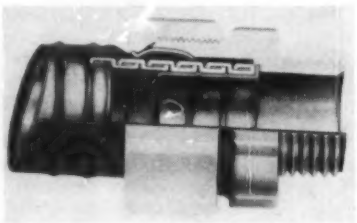
Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.



Electronic Burglar Alarm (19)

The new "Two-Unit Worner Watchman" combines the electronically operated relay and the photocell in one unit and the exciter lamp in the other unit. Both units measure 5 in. by 5 in. by 5½ in. The exciter lamp is equipped with removable infrared filter. System is designed for an invisible light beam with a range up to 35 ft to cover the area to be protected. May be regulated for continuous alarm or for alarm to sound only while light beam is broken. Designed specifically for indoor operation.

Worner Electronic Devices, Box 204, Rankin, Ill.

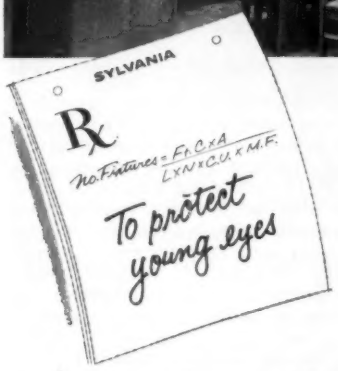


Connector (20)

A new Efcor fitting for liquid tight conduit, called Liquid-Tite. Connector features one-piece design and construction to permit installation without need for disassembling the unit. It also features positive grounding, by a definite "click" which can be heard and felt when conduit is inserted. This occurs because of the special design of the brass grounding insert which has convolutions to match those of the liquid tight conduit. Sealing action is achieved through the use of a brass sealing ring which is an integral part of the connector and is never removed. It is manufactured in a complete range of sizes for straight, 45° and 90° connection.

Electrical Fittings Corp., 37-50 57th St., Woodside 77, N. Y.

Sylvania CP-242 Trimline fixtures bring balanced brightness, minimum glare to the kindergarten room of the new Bowen School, Newton, Mass.



NEEDED: A true "Luminous Environment" with balanced lighting

PRESCRIPTION: Sylvania CP-242 Trimline Fixtures

A high over-all quality of illumination in every room (far more than mere foot-candle level) was the order of the day when the city of Newton, Mass., built its modern Bowen School. *Authorities insisted on a true "luminous environment."*

Noted school architect Louis W. Ross of Boston specified high-reflectance ceilings, walls, floors and furnishings for every classroom; light-green chalkboards; combination fenestrations of prismatic directional glass blocks with natural clear glass strips below; and 2 continuous rows of Sylvania CP-242 Trimline fluorescent fixtures with all-plastic, low-brightness shielding (separate switch control for each row).

Result: Equalized lighting level in every classroom location . . . adequate illumination level for all students . . . with relative freedom from glare and over-brightness at any point. Improved seeing and reading conditions have led to better reading and study habits. What's more—the CP-242 fixtures require maintenance only twice a year, during Christmas and Summer vacations.

This is only one of many lighting "prescriptions" that could be compounded for your needs with Sylvania's full line of school fixtures. Have the Sylvania lighting specialist in your area drop in for a consultation or group meeting at any time—he is a qualified expert in all phases of school lighting.

SYLVANIA®

. . . fastest growing name in sight

Lighting • Radio • Electronics • Television • Atomic Energy

SEND THE COUPON FOR FREE INFORMATIVE BOOKLET

SYLVANIA ELECTRIC PRODUCTS INC.
Dept. M40, One 48th Street, Wheeling, West Virginia

- ☐ Please send me your free informative booklet, "Some Whys and Hows of Modern School Lighting."
- ☐ Have a Sylvania lighting specialist call on me.

Name_____ Title_____

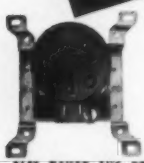
Organization_____

Address_____

City_____ Zone_____ State_____

Everything in one package . . .

GUARANTEED F WIRING DEVICES



No. 365T RANGE AND POWER RECEPTACLE, FLUSH MOUNTING. Heavy Bakelite with Patented Swing-away Terminals that prevent dropping or losing of parts. Allows easy one-hand wiring. Polarized for Range and Power Cords. Designed for 4" or 4 11/16" square box. 50 Amps. – 250 V.

No. 3550 3-WIRE RANGE AND POWER CORDSET. All Rubber, 36" Long. Blades are Welded to Wire. No solder is used. One piece molded rubber cap. Includes cable clamp. 50 Amps. – 250 V.

No. 3601-SSRG STEEL RANGE RECEPTACLE PLATE, SPRAYED BRASS FINISH. Grounded.

No. 365O RANGE AND POWER RECEPTACLE, SURFACE MOUNTING. Heavy Bakelite with Patented Swing-away Terminals that prevent dropping or losing parts. Allows easy one-hand wiring. Polarized for Range and Power Cords. Heavy steel back plate has knockouts for ¾", 1", 1¼" conduit. Has built-in cable clamp for back or bottom wiring. Complete with mounting screws. 50 Amps. – 250 V.

50 YEARS

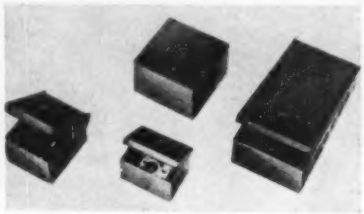
CIRCLE F MFG CO.

TRENTON 4, NEW JERSEY

Battery (21)

A maintenance-free, hermetically sealed battery, marketed under the trade name Voltabloc. It performs efficiently in environmental temperatures ranging from minus 40°F to plus 160°F. Peak discharge rates up to 20 times capacity are permissible, and the batteries may be stored indefinitely in any state of charge or discharge. Available in sizes from 0.8 amp hours to batteries with discharge peaks equal to any requirement now known. Literature is available.

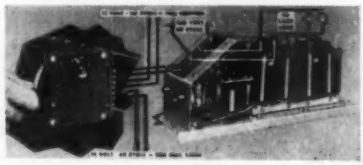
Saft Corporation of America, Gregg St., Lodi, N. J.



Boxes and Cabinets (22)

A complete engineering and custom manufacturing service on special boxes and cabinets of any design, size or specification is now available. This new service is offered to provide the electrical contractor with labor-saving, material-conserving special boxes and cabinets to meet the requirements of "problem" wiring situations. Custom boxes and cabinets can be supplied in every type, size or gauge of steel required, with various styles of hardware, catches, and locking equipment available upon request. Knockouts are not furnished but special knockouts to individual specifications can be furnished. Standard finish is a corrosion resistant, baked gray enamel.

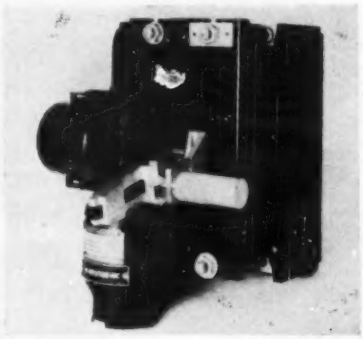
Keystone Manufacturing Co., 23328 Sherwood Road, Center Line, Mich.



Light Dimmer (23)

A miniature light dimmer control with all the facilities of a large switchboard installation, known as the Luxtrol Magamp light controller. Features include presetting to any number of presets; proportional mastering; proportional grand mastering; instantaneous switching from preset to preset; proportional fading at any desired speed from preset to preset, "pile-on" of preset on preset either instantaneously or proportionally, and control from one or more stations. The new system is adaptable to large or small installations from a single selector station controlling a single magnetic amplifier dimmer to a complete switchboard in miniature. It may be installed in any out-of-the-way space, and selector station may be located in the place most convenient for control. It consists only of static fixed-ratio transformers, selenium rectifiers and remote selector control.

Superior Electric Co., Bristol, Conn.



Circuit Breakers (24)

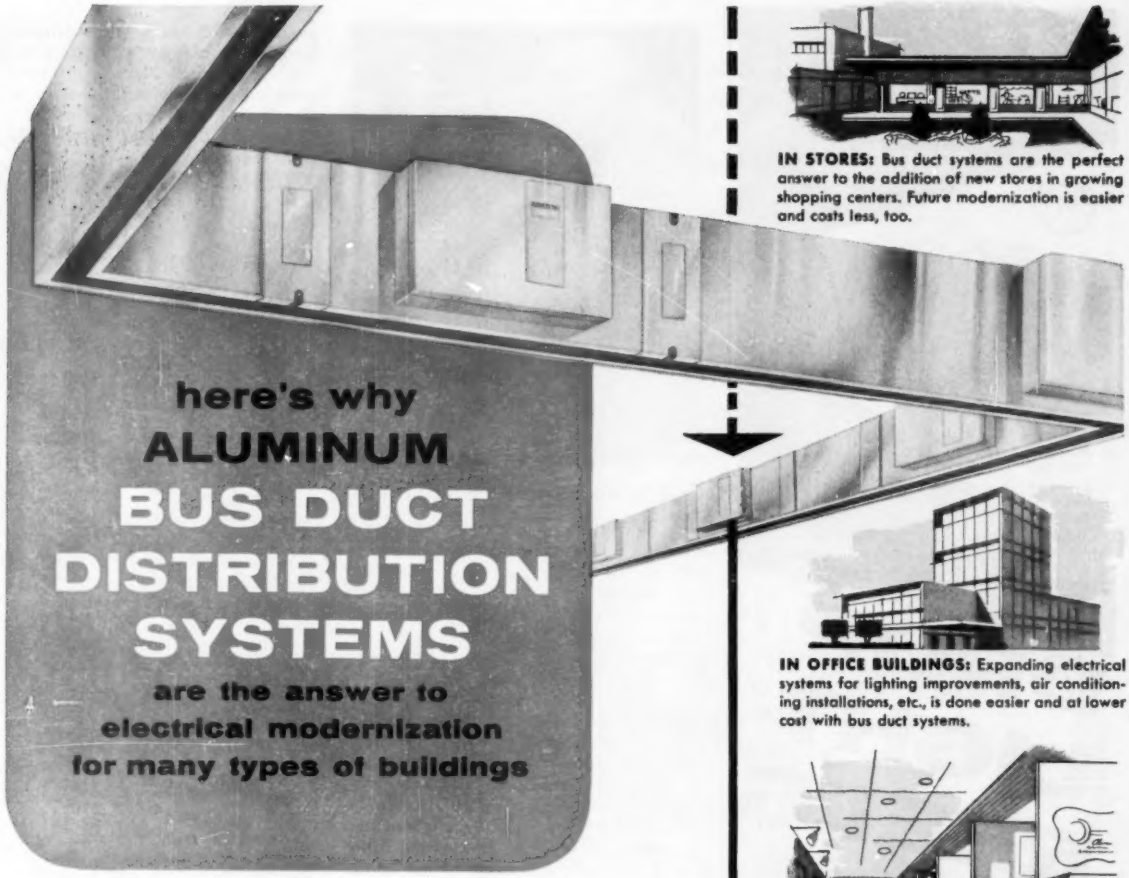
Motor-operated Type J circuit breakers are now available in 2- or 3-pole models and in current ratings from 70 to 225 amps. Standard operating motors can be supplied for 120 or 240 volts, ac or 125 or 250 volts, dc. Breakers combine in a single unit all equipment necessary for electrical switching, thermal protection against overloads, and magnetic protection against high fault currents. It can perform up to four switching operations per minute for extended periods. Auxiliary features available include a front-mounted operator, undervoltage tripping, shunt tripping, and bell alarm.

Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.

Electrical Tape (25)

The use of Bi-Seal self-bonding (polyethylene based) electrical tape as the primary insulation for permanent, watertight sealing of conductor joints in cathodic protection cable has been announced. The Bi-Seal is applied to a specified thickness over the conductor joint and is extended along the cable jacket for at least two inches at each end of the conductor. A jacketing tape applied over the Bi-Seal completes a splice that meets the requirements for permanent, moisture-proof underground installation. Bi-Seal is also fungus-proof and withstands the attack of soil bacteria.

Bishop Manufacturing Corp., 2 Canfield Road, Cedar Grove, N. J.



here's why
ALUMINUM BUS DUCT DISTRIBUTION SYSTEMS
are the answer to electrical modernization for many types of buildings

Bus duct electrical distribution systems save time, material and money in stores, office buildings, schools, auditoriums, convention halls, factories and other buildings. The flexibility of these systems is practically unlimited. Outlets are always at hand and circuit changes are made quickly and easily. Wire waste is held to a minimum. Bus duct is also practically 100% salvageable—can be removed from existing installations and used elsewhere without appreciable loss of material.

New RABC (Reynolds Aluminum Bus Conductor) Offers Important Advantages in Bus Duct Distribution Systems

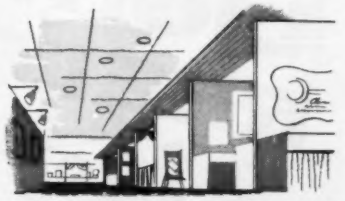
Users get more conductivity per dollar; long range availability; light weight which permits faster, lower cost installations when RABC is used as conductor material. RABC is available in an unlimited range of sizes and shapes and is stronger than other aluminum conductors.

Reynolds does not make bus duct distribution systems, but we would like to send you more information about their advantages. Write for literature, and, if desired, names of system manufacturers to *Reynolds Metals Company, P.O. Box 1800-ET, Louisville 1, Kentucky.*

See Reynolds New Program "Frontier"—Sundays on NBC-TV

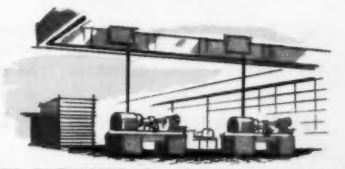
IN STORES: Bus duct systems are the perfect answer to the addition of new stores in growing shopping centers. Future modernization is easier and costs less, too.

IN OFFICE BUILDINGS: Expanding electrical systems for lighting improvements, air conditioning installations, etc., is done easier and at lower cost with bus duct systems.



IN AUDITORIUMS, CONVENTION HALLS: Ready availability of electric power to booths or exhibits is assured easily and economically by bus duct systems.

IN SCHOOLS: Today's schools are constantly being enlarged. Bus duct systems are the flexible, low-cost means for expanding electrical modernization.



IN FACTORIES: Bus duct systems minimize down-time for machinery relocations; permit lower cost electrical modernization and plant expansion.

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

Cordomatic

AUTOMATICALLY CONTROLLED

A rugged and dependable piece of equipment that gives you light where you want it... when you want it.

*Reg. U.S. Pat. Off.

DROP LIGHT REELS

13.95

20' LENGTH
30' AND 40' LENGTHS SLIGHTLY HIGHER PRICED

- ★ Crack-proof phenolic pistol grip handle includes the time proven LEVOLIER toggle-action switch and socket.
- ★ New type heavy duty, all steel, all chrome reflector with swing-open guard.
- ★ Heavy gauge steel casing... smartly styled with a strikingly new textured finish... grease and oil resistant and set off by gleaming chrome trim.
- ★ Underwriters' approved SJ Neoprene cord features a kink proof, moulded-into-core jacket construction... oil and water resistant.
- ★ Fool-proof gravity action locking mechanism has nothing to break or jam.
- ★ The UNDERWRITERS' LABORATORIES INC. seal on CORDOMATIC DROP LIGHT REELS is your assurance of safety and dependability.

Cordomatic*

DIVISION OF THE VACUUM CLEANER CORP. OF AMERICA

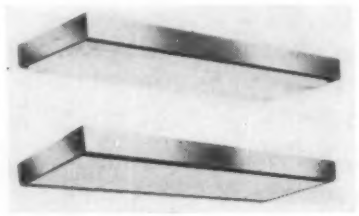
1724 INDIANA AVENUE

PHILADELPHIA 32, PENNSYLVANIA

Coil Winder Drive (26)

A new all-purpose bench model coil winder drive designed as an all-purpose unit for the small motor repair shop and as a standby or second unit in the large shop. It handles field, mush, armature coils up to 5 hp as well as solenoid, electromagnet and other small coils. Speed adjustments are obtained by means of three speed pulleys on the motor in the gear box. The clutch and brake are controlled in one operation. A standard type lathe face plate is adaptable to all types of winding heads. Unit will accommodate a 40-lb load on the face plate at top speed of 360 rpm. When unit is mounted in center of a bench, the swing from center of shaft to bench is 13 in. Model No. 2050 operates on 120 volts, 50-60 cycles with a ⅓ hp motor enclosed.

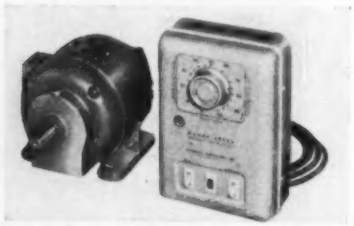
Crown Industrial Products Company, 1050 Amsterdam St., Woodstock, Ill.



Lighting Fixture (27)

The 6600 series Visionaire is a shallow, surface-mounted unit of contemporary styling, designed to make lighting an integral part of the architecture. The QSDP6600 series features a single-piece, smooth dropped Plexiglas diffusing medium with matte-finish. The Plexiglas element is fully framed and supported on reinforcing ledges. The QPLM6600 series with a fully framed, one-piece, miniature-celled plastic louver offers 43° by 43° shielding. On all 6600 series, a "hook-on" hinge allows panels to swing open and remain hanging from fixture body or to be lifted out. When closed, panels are held in place by spring catches. These 2-lamp, 1-ft by 4-ft units are shallow (4⅝-in.). All units are Bonderized and finished in baked white enamel. The series is also available with single-piece, geometric-designed Plexiglas or with Albalite, "Skytex" or Pattern No. 70 diffusers. All units are available in fluorescent or slimline 24-, 48- or 96-in. lengths.

Sunbeam Lighting Company, 777 East 14th Place, Los Angeles 21, Calif.



Variable Speed Drive (28)

A new line of variable speed drives, called Magne-Speed, consisting of Size I and Size II, covers a range from ¼ to 1½ hp. Features are stepless instant starting, compact design, 50:1 speed range with good regulation using simple maintenance free circuitry. Reversibility, dynamic braking, local or remote control may be specified. Bulletin S580-5-55 is available.

Magnetic Amplifiers, Inc., 632 Tinton Ave., New York 55, N. Y.

Lighting Fixture (29)

A new fluorescent lighting fixture, called the "Accenter", can be used in a variety of lighting applications, including counter, chalkboard, bulletin board, sign and light combinations and other "custom" applications. The plastic panels are removable so unit can be mounted either individually or in continuous rows. Because of its "open back" design, it provides "accent" lighting to highlight merchandise and selling areas. It comes equipped with trigger or rapid-start ballasts and is available in 2-ft, 4-ft and 8-ft sections.

Carter Lighting Company, Chelsea 50, Mass.

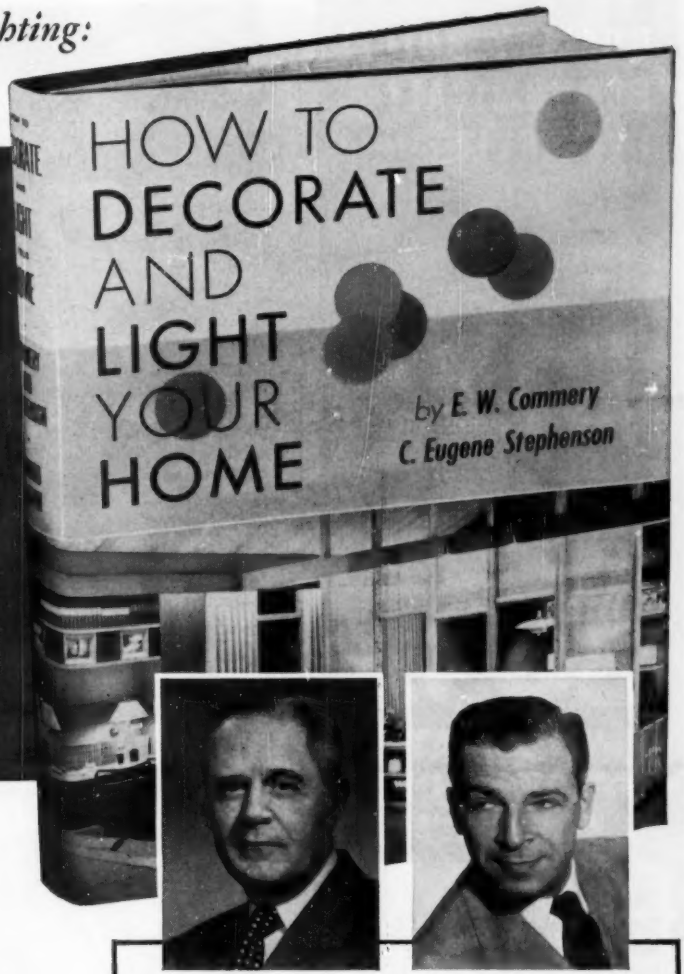
Ballasts (30)

Seven new ballasts for operation of high output, rapid start fluorescent lamps have been announced. Together with previously announced models, the new ballasts complete a full line of 118-volt, 60-cycle, 2-lamp ballasts for 800-ma operation. Models are available for indoor and outdoor low temperature operation of 8-, 6- and 4-ft rapid start lamps.

General Electric Company, Schenectady 5, N. Y.

Important news about home lighting:

General Electric proudly recommends the first authoritative book ever written combining GOOD LIGHTING AND INTERIOR DECORATION



Here's the new standard handbook on how to use home lighting effectively.
256 pages!
More than 100 drawings!
28 full color sketches!

ABOUT THE AUTHORS: E. W. Commery (*left*), dean of American home lighting experts, Fellow of I.E.S., is in charge of residential lighting for General Electric. C. Eugene Stephenson (*right*) is a nationally-known decorator, twice president, American Institute of Decorators.

THIS is the book that explains the newest concept in decoration and home lighting—how to use lighting as an important and integral part of home design.

It's totally different from any previous work on this subject. Instead of concentrating on a series of pre-conceived rooms, it offers the reader the basic tools of lighting and decoration which can be adapted to any *size or type of home. No other book of this type has ever attempted this.*

When the well-known publishing house of Coward-McCann Inc., decided to bring out a book combining home lighting and decorating, General Electric was pleased and proud that its own E. W. Commery, was chosen as co-author to work with Mr. Stephenson. His 25 years as a residential lighting designer make him well qualified for this valuable contribution.

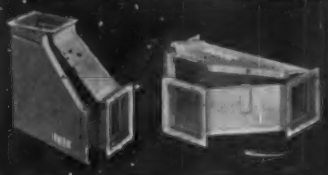
Subjects covered include: how to create color schemes; how to group furniture and make best use of walls, windows, ceilings and floors; how to select and arrange accessories; how to assemble finished rooms; how to make the most of patios and terraces.

Whether you're planning new homes or modernizing old ones, you'll find "How to Decorate and Light Your Home" full of valuable information. Take advantage of the pre-publication price of $5.75, after December 31—$6.75. Get a copy today from your local bookstore. Large Lamp Dept., General Electric Co., Nela Park, Cleveland 12, Ohio.

GENERAL ELECTRIC

QUALITY BUILT!
ECONOMICAL!
FLEXIBLE!

Easily Installed
Saves Time and Money!



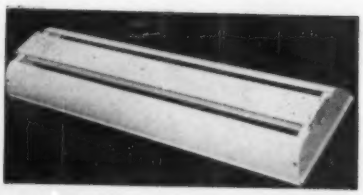
BOSS
WIREWAY
CUT OUT BOXES
CABINETS

QUALITY-BUILT
Code gauge metal, 100% UL approved construction. Firm, but easy-out knockouts. Gray baked enamel finish.

ECONOMICAL
Many years' experience, modern production methods, assure quality—reasonable prices.

FLEXIBILITY
Choice of flanged or flangeless wireway, separate slide-lock or attached hinged cover. Full line lengths, sizes, elbows, junctions, cabinets. Adaptable to any electrical distribution installation.

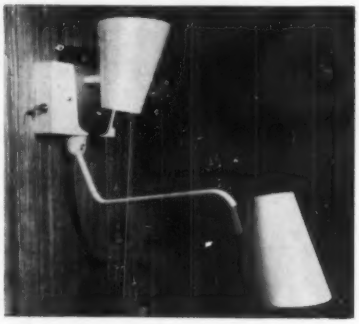
SOLD THROUGH DISTRIBUTORS ONLY
Write Today for Catalogs and Prices
THE HUENEFELD CO.
Cincinnati 25, Ohio



Industrial Lighting (31)

A new industrial fluorescent lighting fixture, called the Bi-Flo Upliter. Construction incorporates porcelain enameled, Center V channel and deep-shielding side reflectors in shallow-designed fixture with continuous openings above the lamps. Approximately 28% of the total fixture illumination is upward, and 72% is downward. Lampholder mounting plates have sloping skirt. Other advantages include slimmer design; sturdy construction; side panels permanently fastened; lampholder spacing automatically maintained; rigid channel cross-section; and rugged side panel support. Improved spring-type latch, operated from either side with one hand, releases reflector. All units interlock at ends for continuous mounting. All types of standard industrial hanging accessories for individual or continuous mounting are available. With louvers, these fixtures make semi-commercial units. Bulletin No. 97 is available.

Wheeler Reflector Company, Boston, Mass.



Hospital Light (32)

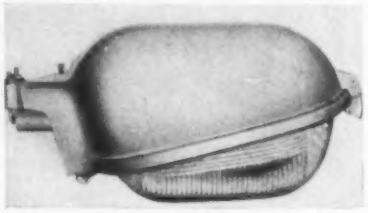
Die cast construction, "Perma-Tension" swivels, and combined direct and indirect lighting are primary features of a new hospital light. It combines all bedroom lighting facilities into one unit. Dual-tension, heavy-duty swivels allow 360° rotation of shade. Base is ⅛ in. cast aluminum. All moving parts are of die cast construction to withstand constant use. Convenience outlet, dual adjustable arms or shorter lengths on adjustable arms are also available. Comes in standard oyster color, gloss gray, green, or brown. Lights may be fitted with any one of four shade styles: metal cone with decorative black knob; gray "Fabriglas" shade; white "Fabriglas" shade with embedded maple leaf; or white "Fabriglas" shade with embedded rattan. All units are supplied with pull-switch.

Prescolite Manufacturing Corp., 2229 Fourth Ave., Berkeley, Calif.

Motors (33)

New rerated improved motor design conforming to the dimensional standards recently adopted by NEMA has been placed in production. New design is designated as type H and is engineered with many improved features and performance. A low air opening in the end-bell protects the winding from liquids and abrasive dust. Currently standard ratings are available in frame sizes 182, 184, 213 215, 254U and 256U. Balance of rerated NEMA line will extend 40 hp 3600 rpm.

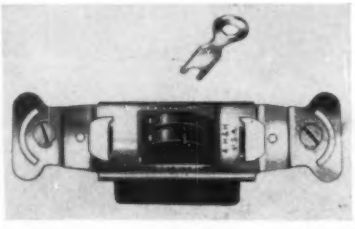
Electro Dynamic Division of General Dynamics Corp., Bayonne, N. J.



Mercury-Vapor Units (34)

The "500G" series mercury-vapor luminaires for street lighting and general outdoor applications is for use with EH1, JH-1, CH-5 or AH-1 lamps. Unit is furnished for 1¼-in. or 2-in. slipfitter mounting, and is available with Alzak processed aluminum reflectors for types 2, 3 or 4 distribution. The Alzak inner reflector is of one piece deep drawn construction. The housing and refractor frames are made from cast aluminum alloy. The specially designed refractor is heavy, clear pressed prismatic crystal glass. An automatic latch and a molded rubber gasket provide a dustproof, weatherproof, and bugproof seal.

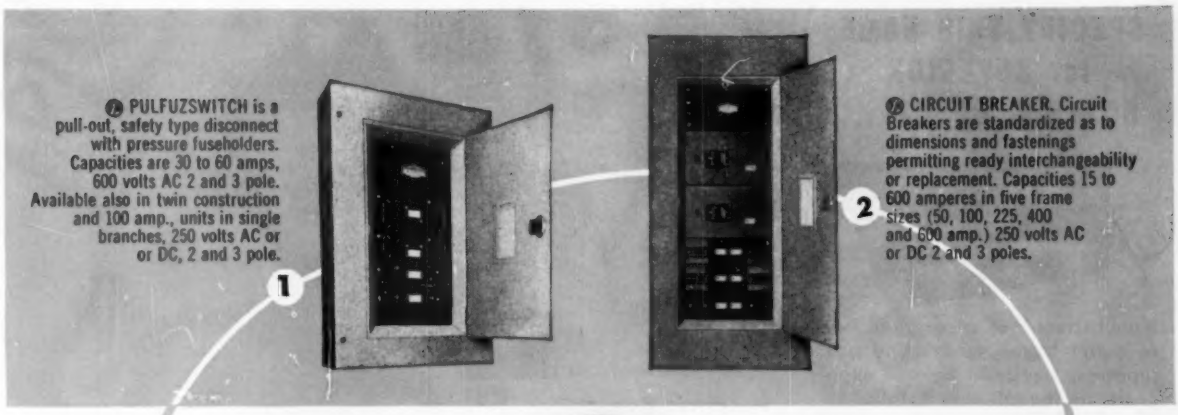
Nepo Manufacturing Co., 6025 North Keystone Ave., Chicago 30, Ill.



Switch (35)

A new interchangeable Quiette lock switch designed with lock-type handle can be turned on and off only with the key provided. It is available in 15-amp, 120-277-volt ac only, single pole, double pole, 3- or 4-way, with either screw or screwless wire-lock terminals and certain types with line shunts—or 20-amp, 120-277-volt ac with binding screw terminals. It is listed as standard by Underwriters' Laboratories.

Arrow-Hart &Hegeman Electric Co., Hartford, Conn.

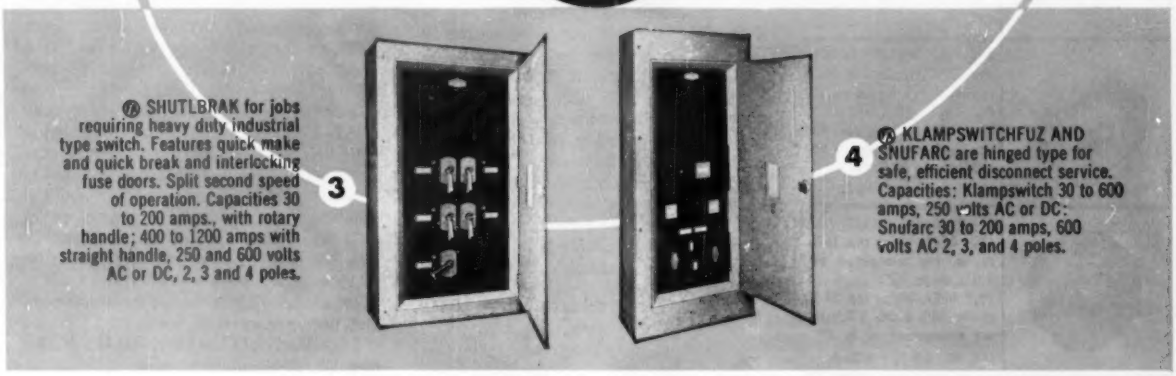

FA PULFUZSWITCH is a pull-out, safety type disconnect with pressure fuseholders. Capacities are 30 to 60 amps, 600 volts AC 2 and 3 pole. Available also in twin construction and 100 amp., units in single branches, 250 volts AC or or DC, 2 and 3 pole.
1
FA CIRCUIT BREAKER. Circuit Breakers are standardized as to dimensions and fastenings permitting ready interchangeability or replacement. Capacities 15 to 600 amperes in five frame sizes (50, 100, 225, 400 and 600 amp.) 250 volts AC or DC 2 and 3 poles.
2

for the finest in safety and efficiency

FA

feeder distribution

PANELBOARDS


FA SHUTLBRAK for jobs requiring heavy duty industrial type switch. Features quick make and quick break and interlocking fuse doors. Split second speed of operation. Capacities 30 to 200 amps., with rotary handle; 400 to 1200 amps with straight handle, 250 and 600 volts AC or DC, 2, 3 and 4 poles.
3
FA KLAMPSWITCHFUZ AND SNUFARC are hinged type for safe, efficient disconnect service. Capacities: Klampswitch 30 to 600 amps, 250 volts AC or DC: Snufarc 30 to 200 amps, 600 volts AC 2, 3, and 4 poles.
4

Choose any one of the four feeder distribution panelboards manufactured by FA and you can be sure of getting the finest in safety, operating efficiency and dependability.

Approved by the Underwriters' Laboratories, Inc., for label service, FA Feeder Panelboards have been carefully designed and engineered to give long-lasting and trouble free service.

Switch units of the Pulfuzswitch, Klampswitchfuz, Snufarc and Shutlbrak are all of the operating type, horsepower rated. Switch and pressure type fuseholders have been combined into one unit so that the current is "off" when fuses are accessible. Too, all current carrying contacts are heavily silver-plated. And for those who want extra safety and convenience the circuit breaker type with automatic circuit protection is unexcelled.

All feeder panels are built in standard boxes 19, 24, 30, and 42 inch widths. Boxes 19″ wide have standard knockouts top and bottom. Others have removable ends to permit drilling conduit openings on the job.

For the finest in safety and efficiency, insist on FA Feeder Panelboards. Your nearest FA representative, listed in Sweets, will be glad to give you more information.

Frank Adam Electric Co.

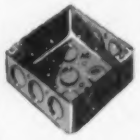
BOX 357, MAIN P.O. • ST. LOUIS 3, MO.
Phone JEfferson 3-6550

makers of:
busduct • panelboards • switchboards
service equipment • safety switches
load centers • Quikheter

SPECIFY THIS NAME for SUPERIOR BOXES & COVERS...

ARROW CONDUIT & FITTINGS CORP.

Manufacturers of a complete line of outlet boxes, covers and box supports. Designed by our engineers, on the job with installation crews. ARROW products answer every modern wiring demand more efficiently.

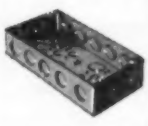


4" SQUARE BOXES
1½" DEEP: Wiring cap. 21.1 cu. in. Any arrangement of K.O.'s up to ¾".
2⅛" DEEP: Wiring cap. 29.9 cu. in. Any arrangement of K.O.'s up to 1¼".
CAT. NO. 4-S-½ • 4-S-71

4-11/16" SQUARE BOXES
1½" DEEP: Wiring cap. 30.5 cu. in. Any arrangement of K.O.'s up to ¾".
2⅛" DEEP: Wiring cap. 43 cu. in. Any arrangement of K.O.'s up to 1¼".
CAT. NO. 5-S-51 • 5-S-71

4" OCTAGON BOXES
1½" DEEP: Wiring cap. 16.5 cu. in. Any arrangement of K.O.'s up to ¾".
2⅛" DEEP: Wiring cap. 24.5 cu. in. With 8 side K.O.'s in any arrangement up to 1"
CAT. NO. 4-O-½ • 4-OO-A

CONCRETE RINGS
1½" to 3" DEEP: Any arrangement of K.O.'s up to 1". (One row of 8 K.O.'s).
3½" to 6" DEEP: Any arrangement of K.O.'s up to 1". (Two rows of 8 K.O.'S each).
CAT. NO. 54521-91



GANG BOXES
1⅝" DEEP: Any arrangement of K.O.'s up to ¾". Available from 2 to 10 gangs. Special depths and K.O.'s on request.
CAT. NO. GB2-10

ALL ARROW PRODUCTS HAVE HOT-DIPPED GALVANIZED FINISH, MANY TIMES HEAVIER THAN U.L. & FEDERAL SPECIFICATIONS.

WRITE FOR OUR NEW CATALOG, TODAY!

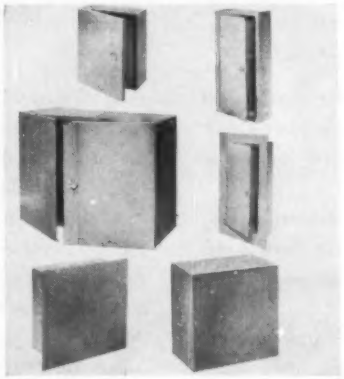
ARROW CONDUIT & FITTINGS CORP.
129 30th STREET • BROOKLYN 32, N. Y.

Sales Representatives & *Warehouse Stocks
BALTIMORE, MD. • CHARLOTTE, N.C. • *CHICAGO, ILL. • *CINCINNATI, OHIO • KANSAS CITY, MO. • *LOS ANGELES, CALIF. • *MIAMI, FLA. • NEW ORLEANS, LA. • NEW YORK, N.Y. • NEWTON CENTRE, MASS. • *PHILADELPHIA, PA. • ROCHESTER, N.Y.

Electronic Range (36)

Cooking is simplified on the new electronic range because temperature controls have been eliminated. A housewife selects high or low speed and sets the timer. The electronic range timer is calibrated in seconds for the first three minutes. The range automatically shuts off when cooking is completed. New oven will bake a potato in 5 minutes and 5-lb rolled rib roast in 30 minutes. Controls on oven are individual high and low speed setting and individual timers for both the microwave unit and browning unit. The oven interior is 18 in. wide, 14 in. deep, and 11 in. high. Oven is aluminum-lined and exterior is finished in Lusterloy brushed chromes. Range will not interfere with radio or TV reception. Electronic range operates on 220-volt electric current from the same type outlet with the same type cable as an electric range. Available in built-in model.

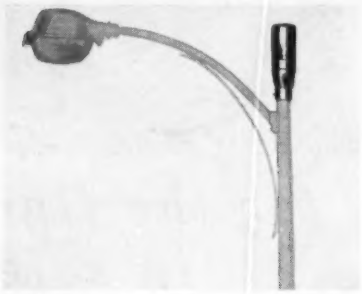
The Tappan Stove Co., Mansfield, Ohio



Cabinets (37)

A new Boss line of electrical cutout boxes, pull boxes, transformer cabinets, telephone cabinets, and custom-built electrical enclosures. It includes more than 80 sizes of Boss Type "A" surface cabinets, which are available in six different depths between 3 and 12 in. The sizes range from 4½ in. high by 5 in. wide to 96 in. high by 60 in. wide. Boxes are electrically welded and furnished with tight door, flanged on four sides. Type "A" style cabinet is suitable for junction, service, switch, panel and cutout cabinet use. The line also includes Type "P" flush cabinets and Type "PS" surface cabinets in sizes between 10 in. high and 10 in. wide to 96 in. high and 60 in. wide, and in depths of 4, 6, 8, 10 and 12 in. Type "P" has a wide flanged front for flush mounting. Approved by UL. Catalog No. CB 4 is available.

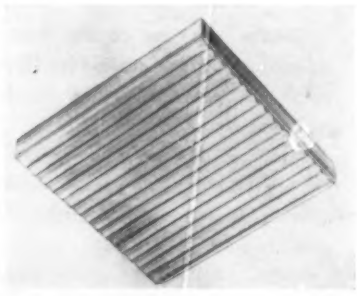
The Huenefeld Company, 2701 Spring Grove Ave., Cincinnati 25, Ohio



Ballast (38)

A new constant wattage ballast, which achieves close regulation of output watts for a 400-watt mercury vapor lamp. Regulation is within plus or minus 2% of lamp wattage. Ballast has a high secondary open-circuit characteristic that allows lamp starting at temperatures well below zero degrees Fahrenheit. It has a split primary winding that permits connection to either 115 or 230 volts. Lamp burnout will not cause ballast failure. New lightweight ballast can be either pole-base, pole-top, or aerial mounted. For all-weather protection ballast case is galvanized and painted and provided with a water-tight, moisture-proof seal, and neoprene-covered leads.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.



Lighting Fixture (39)

A new residential and commercial fluorescent lighting fixture, known as the "Classic". It is 24 in. square and provides high light output with low surface brightness because of its exclusive "Softone" plastic panel shielding. The "snap-in" construction permits simplified installations. Maintenance is simple, since plastic shielding can be removed at will allowing all electrical components to be easily served. A trigger-start ballast eliminates starters.

Carter Lighting Company, Chelsea 50, Mass.

INSTALLATION: Sun Oil Company District Accounting Office, Dayton, Ohio

PROJECT ENGINEER: Alex M. Engart

ELECTRICAL CONTRACTOR: Helldoerfer-Castellini, Dayton, Ohio

FIXTURES: Litecontrol #5524, 2 lamp slimline recessed troffers, using Holophane low brightness lenses, #9033 and #9034

CEILING HEIGHT: 10′ 0″

SPACING: 8′ 0″

FINISHES: Walls, light green — Ceiling, light grey — Floors, light to medium — Desk Tops, medium grey

INTENSITIES: 40 Footcandles in service (intensity figures courtesy Lighting Sales Dept., Dayton Power & Light Co., Dayton, Ohio)

Sun Oil gets More "Mileage" in Lighting – by LITECONTROL

Sun Oil won't have to change its lighting fixtures every 1000 "miles"! This installation uses the very popular Litecontrol #5524 lens which not only does an excellent job *now* but permits the addition of fixtures in the future to make continuous rows, if desired. Note the neat fit of the fixtures in the ceiling and the smartly modern but business-like appearance.

This installation is a repeat performance by Litecontrol for Sun Oil — this time in their new office. It pays to stick with a good brand particularly when experienced counsel in lighting is so helpful and handy. For good light for better vision at standard fixture costs . . : consult *your* Litecontrol Representative.

LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

HERE ARE YOUR

big opportunities

FOR NEW BUSINESS
MORE PROFITS

CHROMALOX

ELECTRIC BASEBOARD HEATERS

provide modern • clean • controlled heat for home • shop • office

You have a really hot item to offer in this modern type of comfort heating. It's . . .

FUNCTIONAL—located along outside walls, it provides true "perimeter heating" through a combination of radiant and convected heat—counteracts cold downdrafts—puts more heat at floor level.

CLEAN—uses the modern fuel—electricity—no smoke, soot, fumes, leaky pipes.

CONTROLLED—room temperatures controlled individually.

EASILY INSTALLED—for single room or complete installation—for "auxiliary" heating or allover heating system. Only two screws to hold it, two wires to connect it—paint to match walls.

Chromalox Electric Baseboard Heaters

. . . available in sizes to fit every need . . . approved by Underwriters' Laboratories.

To get complete information on selecting, installing and controlling Chromalox Electric Baseboard Heaters, send in the coupon.

EDWIN L. WIEGAND COMPANY
7637 Thomas Boulevard, Pittsburgh 8, Pa.

Designers and manufacturers of electric heating units exclusively since 1917

Edwin L. Wiegand Co., Residential Heating Division
7637 Thomas Boulevard, Pittsburgh 8, Pa.

Please send me Bulletin 800 on Chromalox Electric Baseboard Heaters.

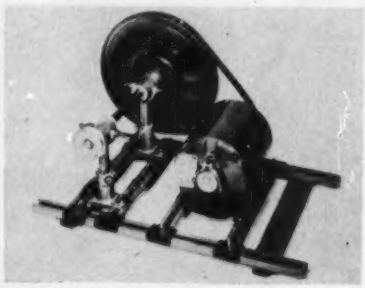
Name_____

Company_____

Street_____

City_____ Zone____ State_____

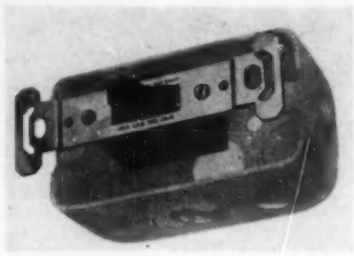
A-4459A



Motor Mount (40)

A new Freeman universal motor mount provides a quick and easy way of "harnessing" fractional horsepower motors and small gasoline engines. Available in three sizes, it provides a mounting for motors. Pulleys can be quickly aligned, and belt tension can be easily adjusted, or tools can be attached for direct drive. It permits "two-way" movement of motor. Motor can be used to pump water, saw wood, operate paint sprayers, sanders, tool sharpeners, air compressors, battery chargers and all power tools. Available in slate gray and maroon finish, it is of all-steel construction.

Arco Manufacturing Co., P.O. Box 817, Grand Forks, N. D.



Switch (41)

The new "Dura-Quiet" switch is ideal for all installations, especially in bedrooms, hospitals, churches, libraries, offices, etc. The body of the switch is small, providing extra wiring room for installation in standard boxes. Connection is made by means of "lock-in" terminals designed to take up to No. 12 gauge wire. Stripped leads are inserted in the holes to make the connection. Grip can be released by inserting a No. 12 wire into another adjacent hole. Switch is available in a 15-amp model, for 120-277 volts ac. It is designed to handle all types of ac loads, including incandescent, fluorescent lamps and ac motors.

John I. Paulding, Inc., New Bedford, Mass.

Varnishes & Compounds (42)

A complete range of Epoxy insulating varnishes and molding compounds has been added to this line, including formulations of modified Epoxy resin base baking and air drying insulating varnishes as well as the 100% solids casting compounds. The compounds can be supplied in the standard two phase form where the activator is added to the Epoxy just before use or the baking compounds can be furnished in a precatalyzed formulation that is ready for use as furnished and requires no addition of activator. They are available either filled or unfilled depending upon the application.

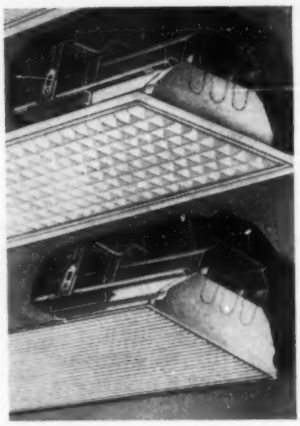
One varnish is an Epoxy clear baking varnish which is thermo-setting yet has the adhesion, toughness, chemical resistance and flexibility characteristic of the Epoxy resins. This material which is designated as K-3829 clear baking varnish has tanking stability; can be cured at normal baking times and temperatures. The surface drying Epoxy varnishes have unusually high wet dielectric resistance and adhesion and have found wide acceptance for a variety of uses including the coating of printed circuits.

George C. Borthig Company, East Rutherford, N. J.

Cable (43)

A new 240-volt cable, approved by Underwriters' Laboratories for both dry wall and plaster construction. Due to its polyvinyl chloride insulation being covered with a nylon coating, the cable is now rated by UL at a heat resistance above that of the previous cable. Advantages are standardization of cable reels, and color coding of new cables in solid colors, so that the wattage of any cable may be determined instantly.

Modernheat Corp., Box 576, Kingsport, Tenn.



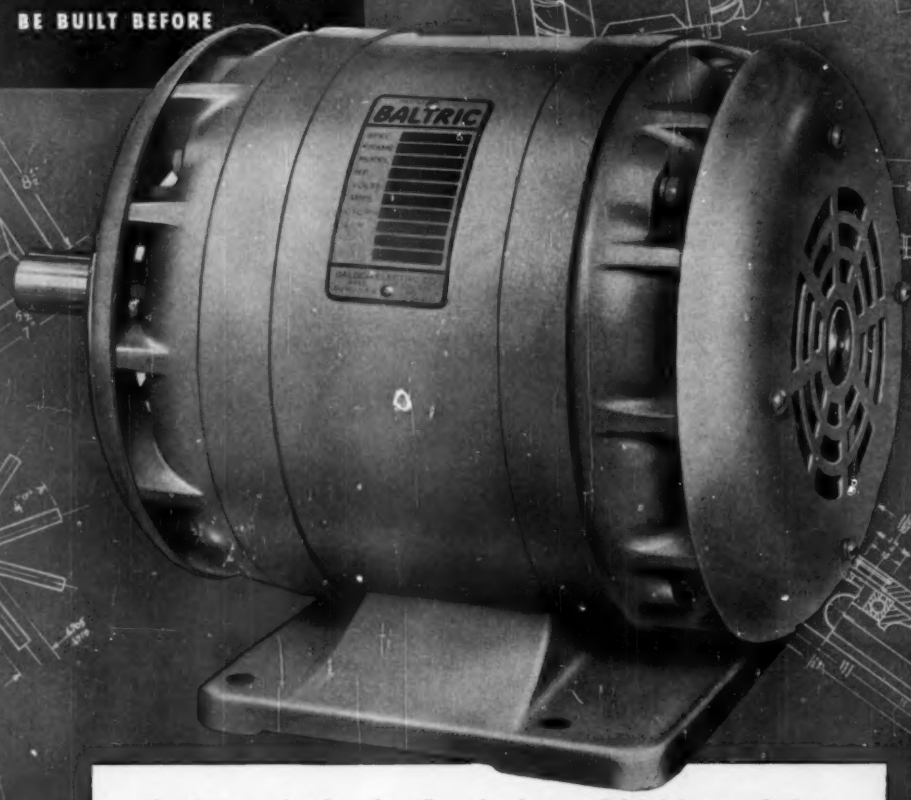
Troffers (44)

A new line of Architectural troffers adaptable to all types of ceilings. Door frames and louvers are removable. A wide selection of shielding media is available, with or without integral trim flange. The precision-manufactured 12-in. module troffer is free from light leaks. Plaster frame is available to insure rectangular openings in plaster ceilings. Patented yoke aligner hanger assembly provides troffer with maximum adaptability to any ceiling condition.

Smithcraft Lighting Division, Chelsea 50, Mass.

BALTRIC...

THE MOTOR THAT COULDN'T BE BUILT BEFORE



Now, in a complete line of totally enclosed motors, Baltric brings you the best answer yet to your motor problems. Less weight . . . less bulk . . . better performance, are the results of advanced engineering and new and better materials.

The new Baltric Motors pack much more power per ounce . . . permit applications and installations of greater versatility. Simple in design, rugged, yet compact and dependable, Baltric does a better job in less space than old-style motors. Baltric is a better bet for every use.

Baltric Motors are available in a complete range of models, ⅙ h. p., through 5 h. p., squirrel cage induction type, both polyphase and single phase. Baltric Motors can also be engineered to meet your special mechanical and electrical requirements.

Original *Streamcooled* Baldor Motors Available—Built to Former NEMA Standards

ALL BALTRIC MOTORS TOTALLY ENCLOSED AND *STREAMCOOLED*

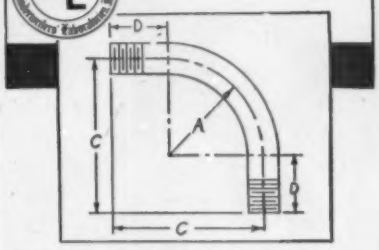
BE55-3

BALDOR ELECTRIC COMPANY

Baltric Motors Are Available in Polyphase
Squirrel Cage • Induction and Single Phase
Capacitor Start • Induction Run Types

4353 DUNCAN AVENUE • ST. LOUIS 10, MISSOURI

conduit of columbus
SIZES OF SPECIAL
LARGE RADIUS
90° ELBOW



radius "A" in inches	offset "C"	straight end "D"	length unbent	pipe sizes
12"	1'9"	9"	3'0"	1"-2½" inc.
15"	2'0"	9"	3'6"	1"-3" inc.
18"	2'4"	10"	4'0"	1"-3½" inc.
24"	2'11"	11"	4'11"	1"-4" inc.
30"	3'5"	11"	5'9"	1"-5" inc.
36"	3'11"	11"	6'6"	1"-6" inc.
42"	4'6"	12"	7'6"	1"-6" inc.
48"	6'0"	12"	8'4"	1"-6" inc.

Also available 45°, 30° and 60°.
All are U.L. approved.

CONDUIT PIPE PRODUCTS CO.,
Conduit by COLUMBUS COLUMBUS, OHIO
SOLD ONLY THROUGH WHOLESALERS

KALAMAZOO
METAL CUTTING
BAND SAW • MODEL 610
CUTS 6" ROUND, 10" FLAT STOCK
Easy to put on your truck and take to the job. Easy to move in your shop. Fast, accurate, rugged. Saves time, effort, cuts costs. Get details today.
MACHINE TOOL DIVISION
Kalamazoo TANK & SILO CO.
1240 Harrison Street, Kalamazoo, Michigan

Fitting (45)

A clamp-on end fitting is used to adapt a slipfitter-end support for mounting a vertical-tapped luminaire hood. The new fitting is designed for use with a 1¼-in. support. The clamp-on feature eliminates the need for a threaded end support and simplifies adjustment of luminaire to the vertical position. Made of aluminum, the fitting matches the styling of the new luminaire supports.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.

Supports (46)

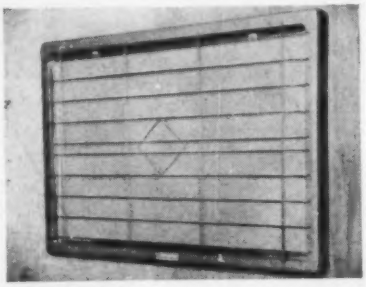
New supports for holding cable and tubing. Supports—trough, ladder, and channel—up to 16 ft are provided. Also channel connectors, fastened with drive rivets for quick assembly, provide a body-bound fit and strength at connection. Another feature is the availability of various lengths of trough, together with extension connectors, that eliminate cutting and drilling in the field. Trough and ladder supports are interchangeable throughout runs. Bulletins are available.

P-W Industries, Inc., Duncan & Melrose Sts., Philadelphia 24, Pa.

Wash-Tank Truck (47)

A new Rol-Away aluminum 5-step ladder wash-tank truck for maintenance of fluorescent fixtures and other hard-to-reach overhead apparatus. It features the patented ladder that slides through the guides when the workman steps on it until its rubber feet rest on the floor. This locks truck and ladder to floor as a unit. It has curved handles to lean against on the sides and a front bar to steady the knees. Truck features twin tanks measuring 10½ by 49 by 10 in. with drain cocks. A full section of a fixture can be dipped down into the tank for washing. The second tank is designed for rinsing water. A large extension shelf holds wash pail or other equipment for the operator.

Rol-Away Truck Mfg. Co., Inc., 6143 S. E. Foster, Portland, Ore.



Wall Heater (48)

A new wall heater with anodized aluminum heating surface. The entire heater is shatterproof and unbreakable. Heater electrically produces radiant rays, similar to those emitted by the sun. They have a low initial inrush of current over their rated capacity. They are for use in homes, apartments, motels, offices, schools, hospitals, nurseries, dressing rooms, service stations, etc. Heaters are available for surface mounting and recessing in walls in wattage ratings of 1250 and 750 for operation on 115, 208, 230 and 245 volts. U. L. approval.

Marviray, Inc., 54 Clifton St., Newark 5, N. J.

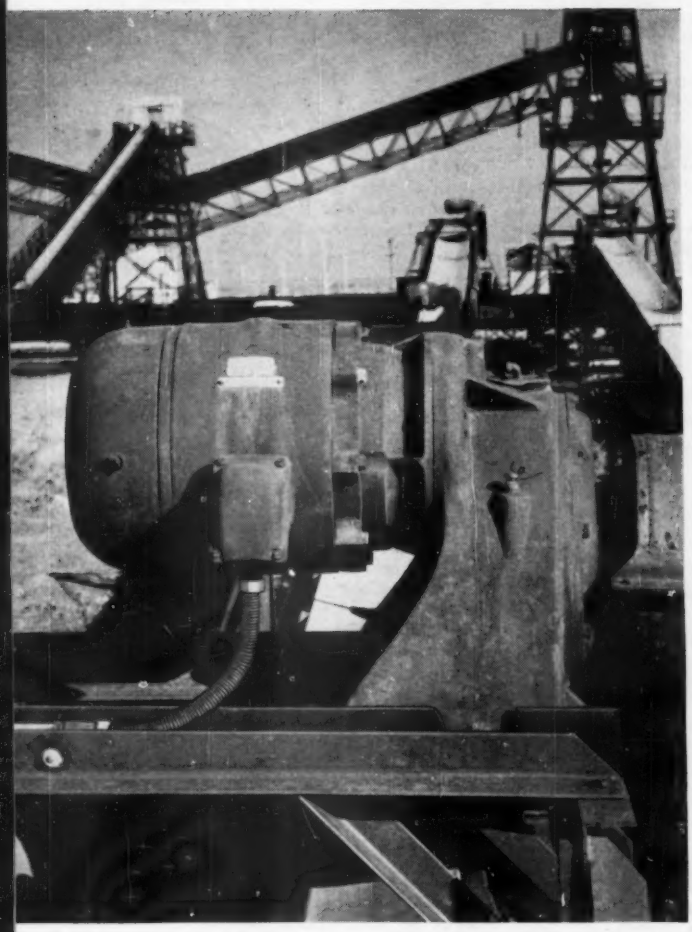
Tester (49)

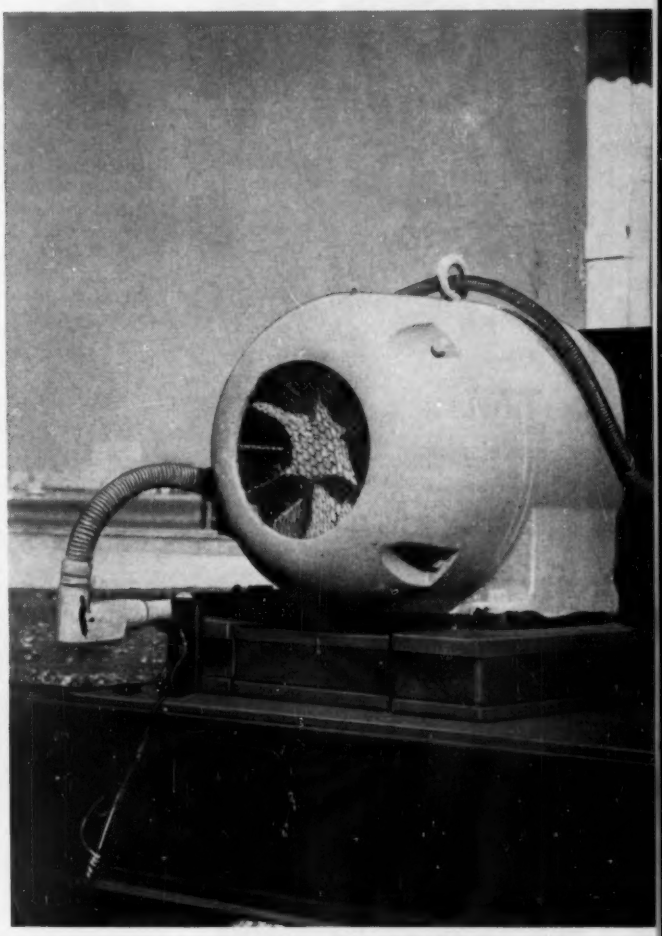
A new high voltage dielectric tester for electrical insulation. The device employs a motor driven voltage controller. The operator can choose any one of 216 rates yielding potential rate of rise of from 33 to 15,000 volts per second. The automatic rate of rise feature gives the operator complete freedom to observe the voltmeter indications and the hands are employed only to momentarily depress the start button. As soon as the specimen breaks down, the excitation is removed from the transformer and the controller motor is automatically plugged with a reduced voltage to a quick stop and immediately reversed to return the controller to zero or start position. The high voltage oil cooled transformer used in this device weighs approximately 500 lbs. and is rated 4 kva-30 kv single phase. It is a 4-coil unit to permit the percentage impedance to be varied from 5% on close coupling to a high percentage with loose coupling.

George C. Borthig Company, East Rutherford, N. J.

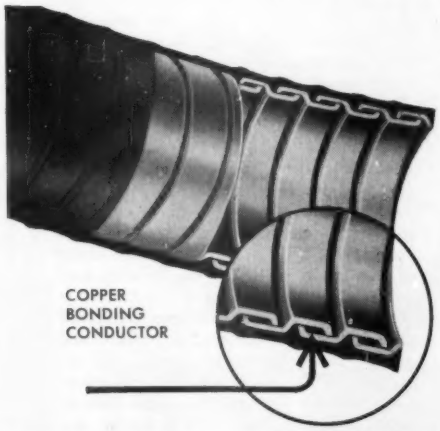
SALT COMPANY STOPS CONDUIT FAILURES

with Sealtite flexible, liquid-tight conduit





Dripping of wet salt and outdoor exposure has had no effect on Leslie Salt Company installation of Sealtite. Long life of this flexible, liquid-tight conduit cuts its over-all cost far below that of so-called less expensive conduit.



Type U.A. Sealtite is approved by Underwriters' Laboratories for service in wet spots. Copper conductor wound spirally inside conduit for positive ground. Type E.F.† (not shown) is extra flexible. Meets J.I.C. standards. Available in machine tool gray at no extra cost from mill stocks.

"Corrosive conditions around our plant are so bad that it wasn't long before the BX conduit installed on our original equipment began to fail," reports Leslie Salt Company, San Francisco. "Wet salt ate through the metal and soon shorted out the circuits.

"Five years ago we decided to replace the BX with Sealtite*. Today, this Sealtite looks as good and is as flexible as it was the day it was put in—despite constant exposure to concentrated salt and the weather—both winter and summer."

Other manufacturers have told us the same story. And many use Sealtite, not only when a flexible conduit is required, but also to save money where corrosive conditions play rough with rigid conduit. For Sealtite's tough, extruded *polyvinyl* outer jacket resists moisture, corrosive chemicals, oils and greases, rain and sun and just plain dirt.

Try Sealtite yourself!

Electrical wholesalers stock Types U.A. and E.F. in easy-to-handle coils. Buy Sealtite in coils and cut it on the job without waste. Special liquid-tight connectors by Appleton, Thomas & Betts, Gedney or Pyle-National are available. For complete information, write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn.

55163

*Trade Mark. †Patent Applied For.

Insist on the original

SEALTITE

FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA**® product

THIEL

DRIVE STRAIGHT

THIEL Proves the Need of a STURDY—STRONG STAPLE. Drives Straight — Will not Bend under any Hard Hitting Punishment. All Cable Jobs MUST have the Sturdiest of Staples. THIEL has the Newest Improvement in these products — THIEL "Easy-Drive" — "Nail-It" — "Easy On" Straps. Sold by reputable Electrical Wholesale Dealers. Send for free samples.

1100 Small (2) Wire Thiel Staples to fer N.E.C. #12-14
1175 Large (3) Wire Thiel Staples to fer N.E.C. #11-12-10

THIEL TOOL & ENGINEERING CO., INC.
1417 N MARKET ST LOUIS 6, MO.

Sound Powered TELEPHONES work in any emergency

because they NEED NO CURRENT

If everything else fails, these phones will still provide trouble-free performance over a distance of many miles. Speaking is activated solely by the sound energy of the voice while ringing is accomplished by a hand-driven magneto. For permanent installation on industrial projects or for temporary use on construction work where they can be moved as the job progresses.

INDOOR AND OUTDOOR MODELS

In selective or common ringing and semi-selective or common talking. Cost of upkeep is negligible.

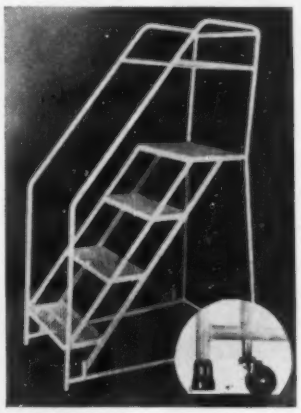
Write for illustrated catalog

HOSE-McCANN TELEPHONE CO., INC.
763 THIRD AVENUE
BROOKLYN 32 N Y

Telephone System (50)

A new 2-to-10 station interoffice telephone system, called Direct-A-Call. It offers the advantages of a telephone communication combined with such services as 2-way loud speaker station, voice paging, conference circuit and loud bell signals for noisy areas. Available to small offices and stores, as well as plants and institutions with work rooms, kitchens and warehouses, it operates from a standard electrical outlet. It is designed so that it can be used either on top of, or mounted on side of a desk and occupies a 4- by 6-in. space. In a typical five phone installation, four pushbuttons on each phone buzz each of the other four stations separately, although businesses needing as few as two, three or four phones, or as many as ten, would use a corresponding number of calling buttons.

Connecticut Telephone & Electric Corp., Meriden, Conn.



Step-Ladder (51)

A new line of all-steel, all-welded industrial step-ladders for use in industry, office filing departments, stockrooms, libraries, banks, assembly floors, etc. Ladders roll easily on four swivel ball bearing casters which retract automatically the instant a person steps on the first step of the ladder. Construction eliminates slipping, rolling, shifting, swaying and tilting. They are flared 3 in. out each side and 4 in. out the rear. In addition, the top step on each model is 12 in. deep and the higher step-ladders are equipped with handrails. Two types of step construction are available: Safety-Grip perforated sheet metal or heavy gauge, small diamond expanded metal reinforced beneath with durable steel bars. Ladders are available with from one to seven steps and in three standard widths, 18 in., 26 in. and 32 in.

Tri-Metal Company, Box 93, Berwyn, Pa.

Cables (52)

A complete new line of portable electrical cords and cables bearing the name Bronco 66 Certified. The outer protecting jacket contains not less than 67.32% new Neoprene. Jackets are branded every two ft. Vulcanized into the outer jacket are the product name, Neoprene content, type, size, number of conductors, rated voltage, and "P116BM". Bronco 66 Certified is manufactured in the following types and sizes: Type SO, sizes 18 through 10, with from 1 to 4 conductors; control cables, sizes 18 through 10, with from 5 to 12 conductors; Type W cable, sizes 8 through 1/0, with from 2 to 4 conductors; Type G cable, sizes 8 through 1/0, with from 2 to 4 conductors; Type SO, single conductor, sizes 18 through 4/0; welding cable, sizes 8 through 4/0. Type SJO and SV-Neoprene cords are also made with the 66 Certified jacket.

Western Insulated Wire Co., 2425 East 30th St., Los Angeles 58, Calif.

Brushes (53)

A series of new brush grades, called the "National" series, is designed to service the complete range of industrial motor and generator applications. Grade N-1 is a low contact drop brush suitable for a wide variety of equipment throughout a broad voltage range. It is a true electrographitic grade, intended to replace the former metal-graphite brushes on some 32-volt equipment, while on standard voltage enclosed machines the electrical losses are held at a minimum when operating at high temperatures. It has especially desirable characteristics for enclosed mill type motors. Grades N-2 and N-6 were designed specifically for electrical machines operating at high temperatures which must be dissipated by radiation. Grade N-4 is a general purpose industrial brush. It is a lamp-black base, electrographitic, non-abrasive brush with a low coefficient of friction. R-64 is particularly adapted to dc excitation rings for the newer types of high speed turbogenerators, as well as small and medium size machines.

National Carbon Company, a Division of Union Carbide and Carbon Corp., 100 East 42 St., New York 17, N. Y.

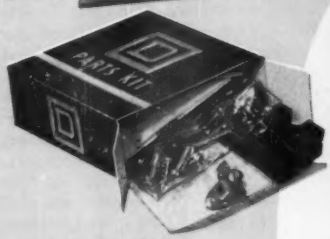
Air-Conditioner (54)

A new type of built-in wall air-conditioner which is drip-free. By means of an exclusive high humidity overflow design, involving drainage of excess moisture into either the building's heating system or a disposal pipe, perfect intra-system condensation disposal is assured in individual units. The Amic unit is self-contained, silent, and weatherproof. Rating for the 1 hp unit is 11,000 Btu's. Simple installation is made possible by use of a steel sleeve which is part of the conditioner and which is delivered ahead of time to be built into the building wall while structure is being erected. Unit is slid into the sleeve and connected after the building is completed. Each unit works under its own power and air supply and is independently serviceable Unit features louvers of anodized aluminum mounted flush with building exterior.

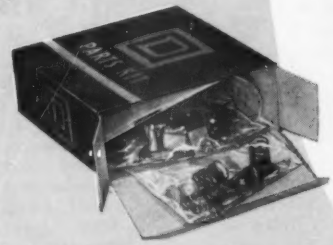
Amic Manufacturing Corp., Long Island City, N. Y.

Qwik Change

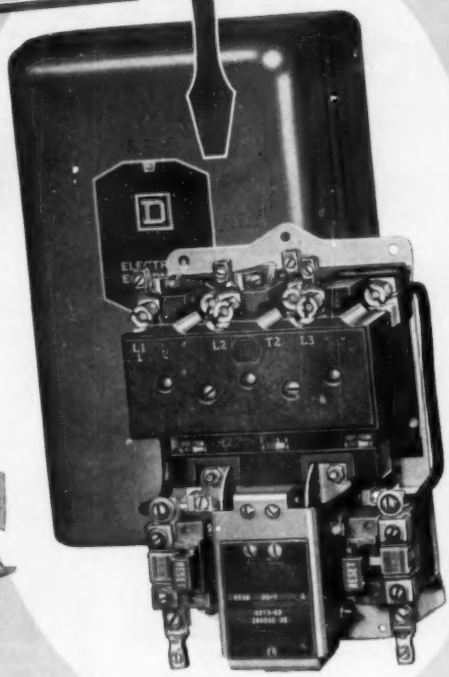
with PACKAGED MOTOR STARTER PARTS!



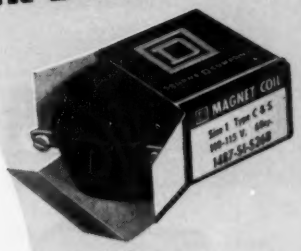
INTERLOCKS
A wide variety of quick-change, front-mounted interlocks adds flexibility for special applications



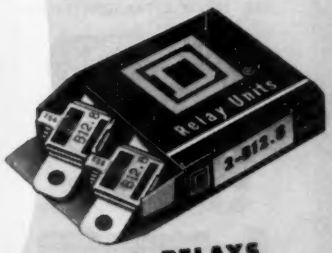
CONTACTS
Packaged replacement contacts are easily installed without disturbing wiring



PUSH BUTTONS AND SELECTOR SWITCH
These Kits contain all parts necessary to make quick changes from standard starters to either push button or selector switch controlled devices



COILS
Screwdriver is only tool required for quick change of magnet coil to accommodate different voltages



O.L. RELAYS
A wide variety of easily selected, packaged overload relay heater units provides quick changes to meet varying requirements for overload protection

EASY to Identify!
EASY to Buy!
FASTER to Install!

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

ARRO ARRO ARRO ARRO

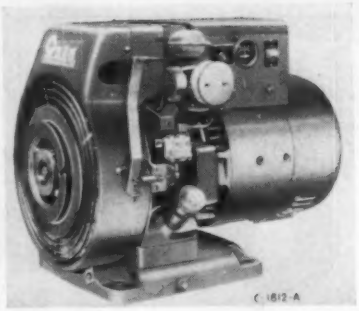
FOR SOLVING YOUR DRILLING
& ANCHORING PROBLEMS
NOW AND FOR THE FUTURE

Always Specify ARRO

TRADE ARRO MARK

See your industrial, hardware or electrical supplier

ARRO EXPANSION BOLT COMPANY
1540 Boone Ave., Marion, Ohio



Electric Plant (55)

A new heavy-duty electric generating plant, Model 2LK, produces 2,000 watts, 60-cycle, ac at 1800 rpm (or 1500 watts at 50-cycles) in all standard frequencies and phases. Model LK is powered by an Onan single-cylinder, air-cooled, 4-cycle gasoline engine with Stellite-faced rotating exhaust valve, large bearings and trouble-free air-cooling. Completely self-contained manual starting models are equipped with patented recoil rope starter, mounted fuel tank, muffler, air-cleaner, terminal box and vibration dampeners. Electrically cranked remote starting models come equipped with mounted control box, exhaust tubing and muffler, air-cleaner, separate fuel tank and battery cables.

D. W. Onan & Sons Inc., Minneapolis, Minn.

Relays (56)

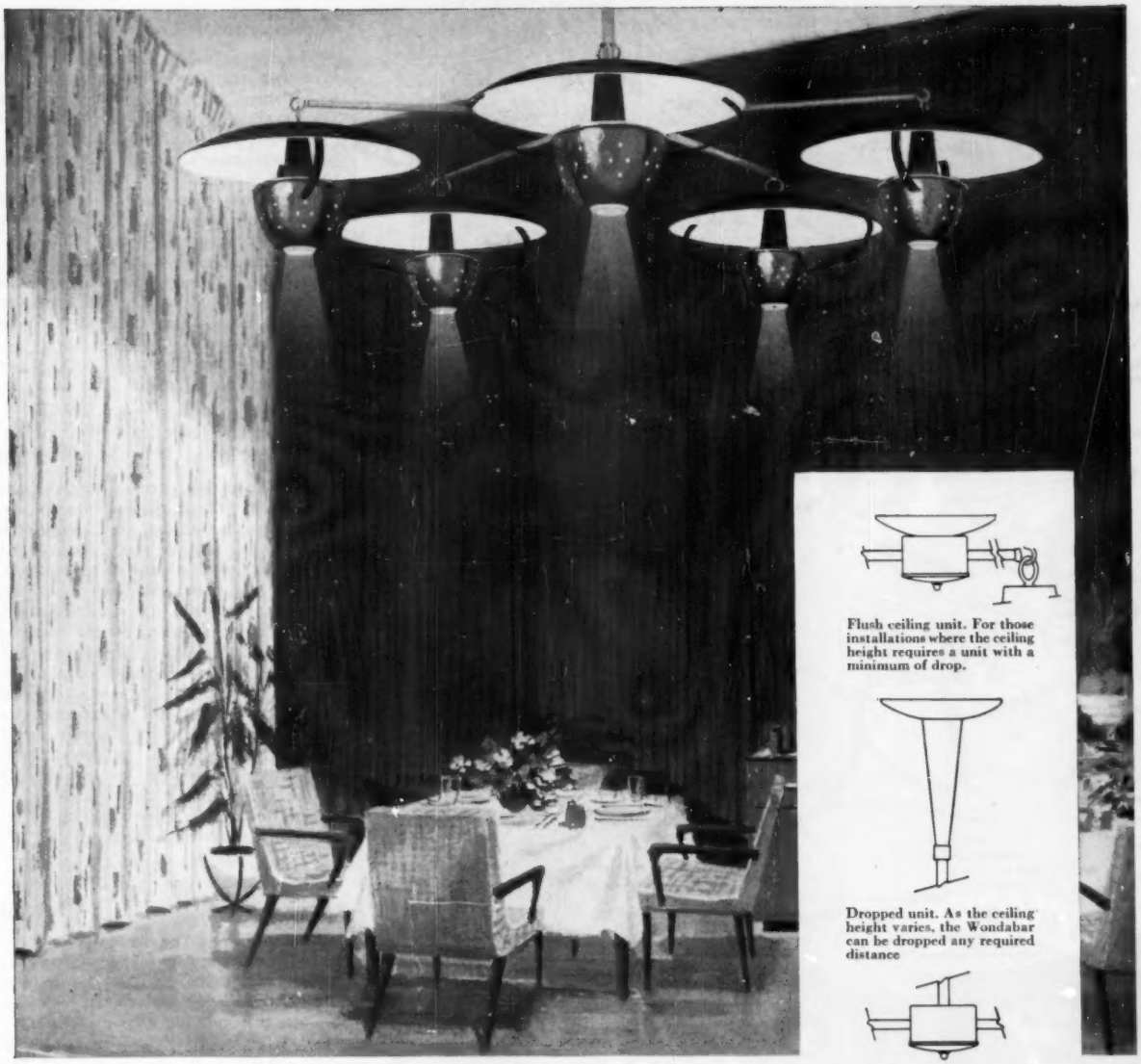
A new line of R4 Series relays which offer a wide variety of applications and switching arrangements. Recommended for fans, circulators or other forms of control where relays only are desirable and independent source of relay coil voltage is available. Encased model should be used if suitable enclosure or conduit connections not available. Relay only, relay on insulating base, relay on steel base or relay in case are all available. Choice of 24-volt, 115-volt, or 230-volt standard ac coil relays. SPST model available with millivolt heating circuit contacts.

General Controls Co., 801 *Allen Ave., Glendale, Calif.*

Emergency Lighting Unit (57)

A new emergency lighting unit, using the new hermetically sealed Dynaseal nickel-cadmium, lifetime battery. Unit includes automatic charging facilities which keep the battery fully charged at all times. It turns on automatically when power fails and restores full battery energy once power is resumed. It contains a charge indicating meter and testing facilities on the front panel to check proper operation. It is available in hermetically sealed containers for use in hazardous atmospheres. Unit mounted lamp assemblies, or with power supply remotely located for multiple lamp installations are available. Bulletins A46 and A71 are available.

Dynaseal Lighting Corp., 5 Hadley St., Cambridge 40, *Mass.*



Flush ceiling unit. For those installations where the ceiling height requires a unit with a minimum of drop.

Dropped unit. As the ceiling height varies, the Wondabar can be dropped any required distance

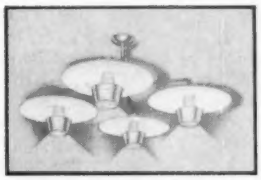
DRAMATIC NEWS IN LIGHTING

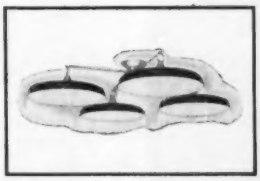
the Wondabar by Virden

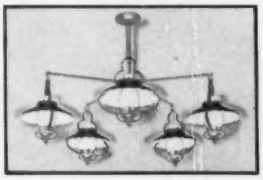
Here it is. Decorative lighting with a custom look *at standard lighting fixture prices.* Now you can offer your customers a new concept in multi-unit lighting with the Virden Wondabar. The specially designed units come in 3, 4, or 5 light sizes—with your choice of drop.

And it's one of the most simple jobs you have ever installed. All you do is assemble and wire the Wondabar kit, install it, and attach the fixtures. Presto—there's a custom-made fixture.

For more information on the Wondabar kit, write for folder W-1. The John C. Virden Company, Dept. EC-12, 6103 Longfellow Avenue, Cleveland, Ohio.





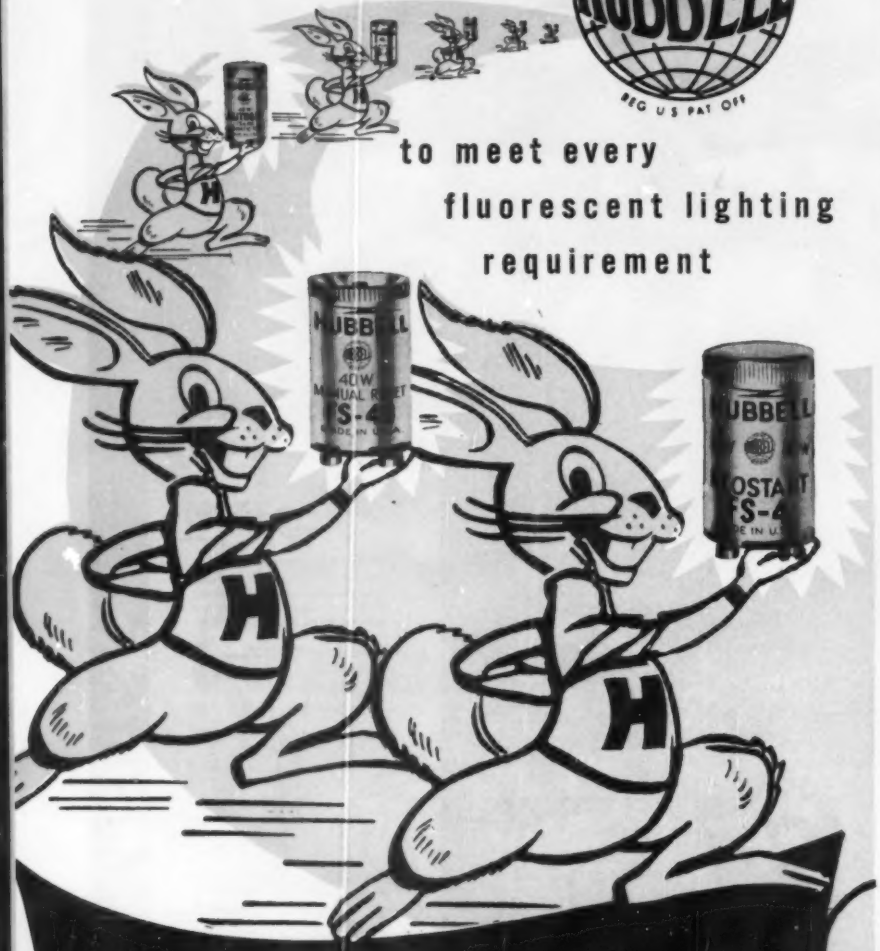


Three applications of the Wondabar to give you an idea of how versatile this kit can be.

Decorative Lighting

VIRDEN

A complete,
fast moving line . . .
HUBBELL
REG U S PAT OFF
to meet every
fluorescent lighting
requirement



Jackrabbit

FLUORESCENT STARTERS
and LAMPHOLDERS

Your plant electricians or fluorescent maintenance men know that a positive way to avoid trouble is to protect the installation with the finest quality starters and lampholders. Now you can be sure of the best by specifying Jackrabbit by Hubbell.

Mogul, Combination Lampholder
Cat. No. 2959

Write for complete information today.

Harvey Hubbell, INC.
Dept. EC BRIDGEPORT, CONN.

SOLD ONLY THROUGH AUTHORIZED DISTRIBUTORS

FACTORY WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

State and Bostwick Sts. Bridgeport 2, Conn.
37 South Sangamon St. Chicago 7, Ill.
103 North Santa Fe Ave. Los Angeles 13, Calif.
1675 Hudson Ave. San Francisco, Calif.
1111 Dragon St. Dallas 7, Texas

Weatherproof Light (58)

The PL-6, 15-watt weatherproof light, is a cast aluminum lighting fixture for walks, steps, gardens, hospital corridors, floors, etc. It is completely shielded, top and sides, to eliminate glare and brightness contrast. Top shield limits light distribution to 120° arc, and weatherproof construction makes possible indoor or outdoor use. It can be used without top shield to furnish a full 180° beam. Unit employs a 15-watt lamp; Fresnel lens directs light outward and downward, and it can be installed on an FS box for flush mounting in concrete, stone or plaster.

Spero Electric Corp., 20500 St. Clair Ave., Cleveland 17, Ohio

Controls (59)

Socket-mounted current controls are designed to actuate oil switches for capacitor bank switching. A 120-volt, 60-cycle source is used for both control and load. The off and on meter contacts, having a minimum band width of ¼ amp, are adjustable over a full scale of 5 amps. Time delay is achieved by the inherent characteristics of the thermal element. Load contacts are designed for a maximum load of 20 amps. A fuse is provided for control circuit. All components are mounted on a standard 6-prong meter base and protected by a glass cover. Socket may be mounted on any suitable surface, either indoors or outdoors.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.

Relay (60)

A new single-pole, single throw, normally open relay for efficient magnetic motor control in industrial across-the-line motor starting and control of heating and refrigeration equipment. Carrying UL approval, this 9191 relay has large current carrying capacity. It has motor load ratings of 1½ hp at 115 volts ac and 3 hp at 230 volts ac. Contact load ratings are for 20 amps on either 115 or 230 volts ac, single phase, and for 114 amps locked rotor at 230 volts ac. Equivalent relays in either 2-pole or 3-pole models are also available.

Leach Corporation, Leach Relay Division, 5915 Avalon Blvd., Los Angeles 3, Calif.

Product Briefs

(61) A new hydro-electric elevating **work tower** for one-man use which plugs into any 110-volt ac outlet, has been announced by Safway Steel Products, Inc., Milwaukee, Wis. . . . . (62) Hitemp Wires, Inc., Mineola, N. Y., has introduced a new line of miniature **coaxial cables** . . . . (63) A new king-size fuel tank for automatic **gas torch** has been announced by Prepo Corporation, Edgerton, Wis.

(64) Electric Machinery Mfg. Co., Minneapolis, Minn., has developed a new "Ampli-Speed" **magnetic drive,** which provides adjustable speed power for a wide range of applications. . . . . (65) A new photoelectric **control** automatically turns on tunnel entrance lights when needed. It is manufactured by Fisher-Pierce Co., Inc., So. Braintree, Boston, Mass. . . . . (66) W. H. Brady Co., Milwaukee, Wis., has developed a self-sticking conduit and voltage **marker** to identify conduit, busways, circuit breakers, control centers, power switches, power lines, switchboards, transformers, utility switches and all types of electrical equipment.

(67) A new black production grade cloth **tape** has been announced by the Permacel Tape Corporation, New Brunswick, N. J. . . . (68) Georator Corporation, Manassas, Va., has developed new "Nobrush" frequency **converters.** . . . (69) A new 3 in 1 **tool** has been developed by Aladdin Manufacturing Co., Kansas City, Mo., which can turn any ¼ in. electric drill into a hack saw, a jig saw or a coping saw.

(70) An insulation impregnating chemical, in use for the past 15 years as a moisture-proofing **compound** for the windings of electrical motors, is now available in an aerosol dispenser. It is distributed by Safe-T-Seal Division, MB Aircraft Services, Inc., Burbank, Calif. . . . (71) Ramset Fastening System, Olin Mathieson Chemical Corp., New York, N. Y., has announced a new **coupling,** called the "Drive-Thru", which is used in place of the conventional threaded stud and coupling. . . . . (72) A packless 3-way solenoid **valve** that operates by a new principle has been introduced by the Automatic Switch Company, Orange, N. J.

(73) The new, field tested Centric Trig-O-Matic overload release **clutch** has been announced by Centric Clutch Company, Woodbridge, N. J. . . . . (74) Gemco Electric Co., Detroit, Mich., has announced a new Model B rotary limit **switch** featuring ratios of 250:1, 500:1, or 1000:1. . . . . (75) A new **stripper solvent,** called Monastrip EP, makes it possible to salvage parts from defective units potted in cured epoxy or polyester resins. It is manufactured by Mona Industries, Inc., Paterson 4, N. J.

(76) Single-row and multi-row **capacitor racks** for 50-kvar units are now being offered by Line Material Co., Milwaukee, Wis. . . . . (77) A new Guardian series 1200 ac or dc **relay,** rated up to 8 amps, at 115-volt, 60 cycles, non-inductive load, is being produced by Guardian Electric Manufacturing Co., Chicago, Ill. . . . . (78) A new water heater **thermostat** designed for extremely accurate temperature control is available from Westinghouse Electric Corp., Pittsburgh, Pa.

ALL NEW!

BRONCO Certified 66

NEW 66% NEOPRENE JACKET

another first from BRONCO

Bronco does it again! Bronco gives you another *first!*

Bronco made the	1ST	standard stock portable cords and cables with NEOPRENE jackets!
Bronco was	1ST	to make cables with protecting jackets containing a high percentage of NEOPRENE!
Bronco was	1ST	to CERTIFY jacket contents!
Bronco was	1ST	to BRAND* all cords and cables at two foot intervals.
Bronco was	1ST	to bring you SYNCHRO-CURED cords and cables!
Bronco was	1ST	to bring you BIG, EASY-TO-READ labels!

Most of these firsts have never been duplicated . . . are to this day EXCLUSIVE FEATURES of BRONCO products!

NOW, BRONCO MAKES HISTORY AGAIN WITH BRONCO 66 CERTIFIED

The all new Bronco 66 Certified portable cables and cords are protected with jackets certified to contain not less than 67.32% *NEOPRENE.* For toughness and flexibility, this rich new jacket puts Bronco *FAR IN THE LEAD!*

p-sst! p-sst! we're expecting (thanks to you!)

1956 will be our "millionth" year

– the year the millionth Amprobe will be born.

No other volt-ammeter made can boast such universal acceptance!

AMPROBE

PYRAMID INSTRUMENT CORPORATION LYNBROOK, NEW YORK

CATALOGS and BULLETINS

(79) MOBILE POWER SUPPLY UNIT designed for mounting under the hood of auto or any self-propelled vehicle is driven by the vehicle engine. Four models are rated at 3-, 5-, 7½-, and 10-kw ac, will deliver 220-volt, 60 cycle ac current at 3600 rpm. Bulletin C-10, 8 pages, gives applications, dimensions and technical data. Star-Kimble Motor Div.

(80) MERCURY VAPOR LIGHTING. 2 Booklets. "More Light for Less Money", 8 pages. covers 16 types of mercury lamps as to performance application, and specification. The other 8-page bulletin is titled "Today's Most Effective Street Lighting Source". It gives design advantages of mercury vapor for this illuminating job. Sylvania Electric Products Inc.

(81) DISTRIBUTION TRANSFORMERS. Bulletin 61B6159E, 16 pages, tells how "Curvacore" construction and quality control of production improve efficiency and reduce maintenance. Technical data and installation practices for units rated at 3 through 167 kva, single-phase, 15 kv and below. Allis-Chalmers Mfg. Co.

(82) PLASTIC CONDUIT FOR UNDERGROUND installations is described in an 8-page booklet entitled "Economical Cable Conduit". Illustrations demonstrate how labor is reduced and conduit is adapted to system design requirements. Eastman Chemical Products, Inc.

(83) POWER-OPERATED GATE for parking lots. Entrance gate is automatically opened when driver inserts coin, token, or special key; exit gate is also automatic. Form WRRS-955.1, 4 pages, describes components, installation, and economic benefits. Western Railroad Supply Co.

(84) LIGHTING UNITS for commercial and institutional, and indoor and outdoor industrial applications are detailed in a new catalog that gives pertinent design and installation information plus a 12-page section on system design. 60 pages. Holophane Company, Inc.

(85) SWITCHBOARDS. Bulletin GEA-4127B includes 40 pages of descriptive material on design, construction and operation features of switchboards employing the "building block" concept. Eight classifications of boards are covered and basic circuit specifications and equipment are detailed. General Electric Co.

(86) MOTORS AND DRIVES for the machine tool industry are listed in bulletin 1750.

(87) FLUORESCENT LUMINAIRE, called the "Cleer," features plastic eggcrate louver providing 40 by 40 degree shielding and plastic side panels. Form 750, 4 pages. Smithcraft Lighting Division.

(88) ASBESTOS-CEMENT CONDUIT for exposed work and burial without encasement and Transite Korduct for installation in concrete are described in 52-page Products Handbook. Johns-Manville.

(89) MOTORS. Series 100 motors in totally enclosed fan-cooled and open drip-proof types are described. Dimensions, ratings and frame sizes are included in Bulletin N-100-R, 16 pages. Howell Electric Motors Co.

(90) SERVICE DROP CABLE of the N-SD type consists of bare neutral of hard drawn copper, aluminum, or ACSR with two insulated conductors of copper or aluminum cabled about the messenger-neutral. Bulletin DM-5556, Anaconda Wire & Cable Co.

(91) TRIP CONTROLS, affording two-hand clutch control of industrial machines, are the subject of 12-page catalog 65. Micro Switch.

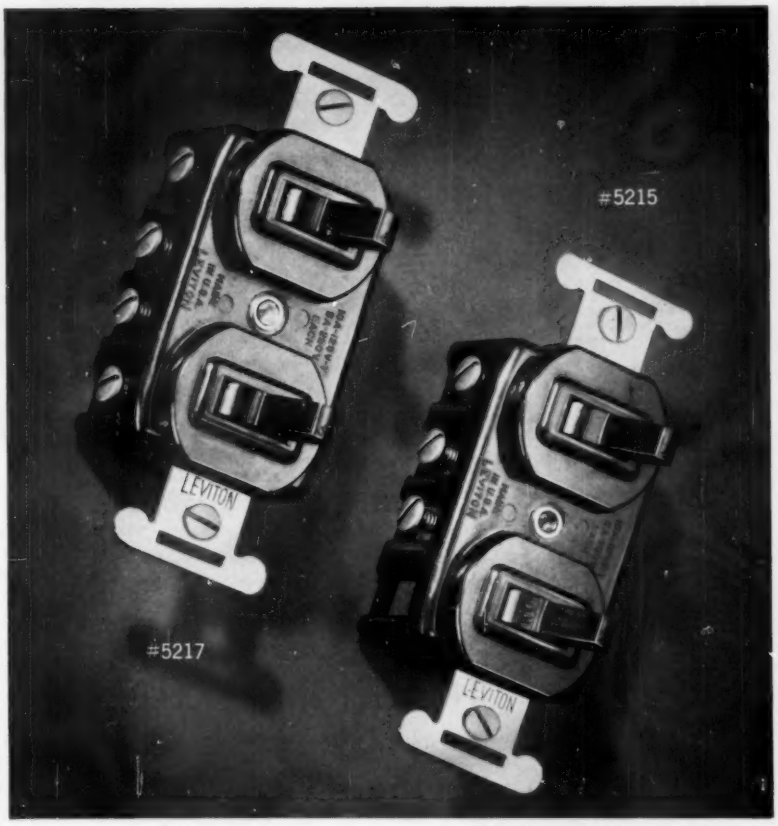
(92) CABLE AND TUBING SUPPORTS of the trough, ladder, and channel types are available in various lengths up to 16 ft. Bulletin 955-D, 16 pages lists complete line with illustrations and dimensions of all types of fittings. P-W Industries, Inc.

(93) LUMINOUS CEILINGS with a wide choice of shielding media, including louvers, lighting glassware, lenses and plastics, are described in 24-page catalog that features extensive system design and installation data. Columbia Electric & Mfg. Co.

(94) SERVICE PROTECTION EQUIPMENT, including service entrance equipment, safety switches, and lighting and distribution panels for homes, multiple dwellings units, and commercial buildings are described in a 32-page Product Selector. American Electric Switch Div., Clark Controller Co.

(95) ALUMINUM SERVICE DROPS, consisting of two insulated aluminum conductors cabled about a messenger of aluminum or ACSR, are discussed in 22-page booklet EC-42-56. Kaiser Aluminum & Chemical Corp.

(96) WEATHER - RESISTANT SHIELDS of Plexiglas for outdoor applications of fluorescent lighting. Booklet PL-242, 16 pages. Rohm & Haas Co.



To bring you the best in wiring devices . . .

LEVITON *announces* **2 NEW ADDITIONS** *to the* **"5000" QUALITY LINE**

There is no finer line of combination wiring devices than the Leviton "5000" series. Now, with these two new switches, the "5000" series assures complete selection for every requirement.

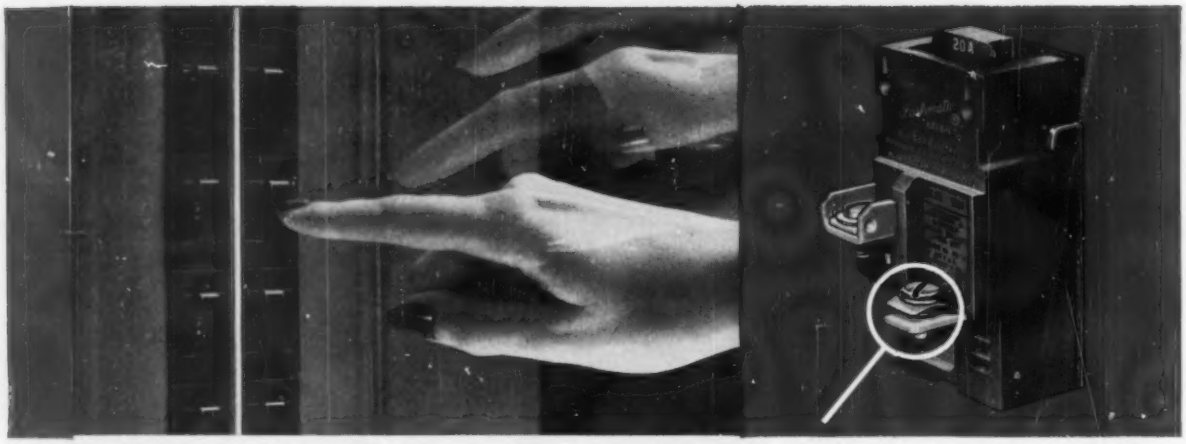
These heavy duty switches are type C, T-rated: #5215, one single-pole and one 3-way switch in a single unit; #5217, two 3-way switches in a single unit. Both switches are independent of each other on the same circuit and designed to fit standard duplex wall plates. Sturdy construction with cover in either brown or ivory phenolic. Each rated 10A-125V-T, 5A-250V. Listed by U.L. and C.S.A. Meet R.E.A. and Federal specifications.

Always specify LEVITON "5000" LINE for long, trouble-free performance:

#5000—T-Slotted Duplex Outlet
#5001—Single Pole Switch
#5211—Single Pole Switch & Outlet
#5212—Duplex Single Pole Switches
#5213—Single Pole Switch & Pilot Light
#5214—Duplex Switches—Separate Circuits
#5215—Single Pole & 3-way Switch
#5217—Two 3-way Switches

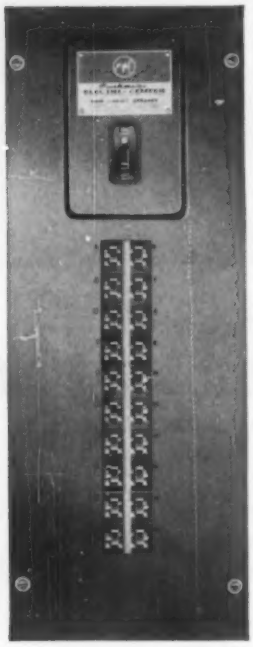
your best jobs are done with . . . **LEVITON**

LEVITON MANUFACTURING COMPANY • BROOKLYN 22, N. Y.
Chicago — Los Angeles — Leviton (Canada) Limited, Montreal
For Best Results Use Wire By AMERICAN INSULATED WIRE CORPORATION



Duo-Guard Pushmatics® in BullDog Electri-Centers protect branch circuits *and* appliance cords . . . safely, automatically. And they're convenient. Just a "push" restores service. No fuse boxes . . . no fuses to change. No danger of electric shock, either.

The new terminal screw retainer in each Duo-Guard provides bolted connections . . . makes installation fast, easy. No lost screws. No special tools.



NOW! FROM BULLDOG

one main disconnect, full 100-amp service

IN ONE COMPACT PUSHMATIC PANEL!

BullDog's new 100-amp service panel combines full 100-amp service with the convenience and protection of one main service disconnect—all in a single Pushmatic Electri-Center®.

A special I-T-E breaker in the upper section of the panel serves as the main disconnect . . . eliminates the need for a safety switch. Installation is easier, faster, *safer*. And homes are more modern—more fully protected.

Famous Duo-Guard Pushmatics in the lower section automatically protect and control all branch lighting circuits and all 110-220 volt appliance circuits. Pushmatics mean pushbutton convenience, too—an end to the bothersome fuse box and fuse fumbling.

Specify and install this advanced, new BullDog service panel. Available with 14 or 20 circuits, it can be located anywhere in the home or office . . . assures adequate wiring capacity for all present and future needs. Listed by UL. Check your qualified BullDog distributor or field engineer Or, write BullDog Electric Products Company, Detroit 32, M igan. © REPCO

IF IT'S NEW
. . . IF IT'S DIFFERENT
. . . IF IT'S BETTER . . . IT'S

BULLDOG
ELECTRIC PRODUCTS COMPANY
A Division of I-T-E Circuit Breaker Company

Export Division: 13 East 40th Street, New York 16, New York. ***In Canada:*** BullDog Electric Products Company (Canada), Ltd., 80 Clayson Road, Toronto 15, Ontario.

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

DC Filaments in Vacuum Tubes

QUESTION Z28—We have a large sound equipment installation, using about 320 watts of audio power. We are considering powering the filaments of these tubes with dc current to reduce hum, instead of ac. However, someone has said that this will shorten tube life. If so, what is the reason?—L.W.F.

ANSWER TO Z28—There is no sound basis in saying that the tube life will be shortened in powering the filaments of the tubes with dc rather than ac. Alternating current to heat the filaments of sound equipment tubes is entirely permissible since the large signal output overshadows the hum. There are methods to reduce this hum by bringing the grid and plate return leads to a point at the same potential as that of the mid-point of the filament.

Also, there are tubes designed for ac operation where the magnetic and voltage-drop effects tend to balance out.

There are other ways to reduce this ac hum but to answer your question, conversion to dc powered filaments is possible without shortened tube life, which is readily seen in dc powered equipment, battery and rectifier powered equipment.—J.B.K.

ANSWER TO Z28—The use of either ac or dc on the filaments of radio tubes will have no effect on the life of the tube. This is provided the rated voltages are used as specified. A simpler method of reducing hum is to apply a dc potential between the cathode and the heater of the tube. The reasoning behind this scheme is as follows. When the heater is fed with ac, there is a 120-cps variation in the temperature of the filament. The filament emits electrons to the cathode. This variation in temperature causes a variation in emission of electrons to the cathode, and therefore a variation in the cathode potential; resulting in a 120-cps hum. If the cathode is kept negative relative to the heater, the electrons will be repelled back into the heater, and therefore the only effect of the ac current through the filament will be to vary the temperature of the filament, and hence as a second order effect, the temperature of the cathode. We have found that a voltage of around 20 to 30 volts will give appreciable reduction in hum.—H.H.S.

Using Heat to Shrink-on Bearings

QUESTION A29—When motors are cleaned and repaired, I use a puller to take off the bearings, but when replacing the bearing, I use an induced heat to expand inner race enough to slip the bearing over the shaft. Does induced heat affect the bearing later, or would it be better to press the bearings on cold?—E.S.H.

ANSWER TO A29—Induced heat will not harm the bearing if properly applied. Bearing manufacturers recommend pressing bearings on or shrinking them on by expanding the bearing.

The best method of expanding is by heating the bearing in clean oil for about 15 minutes to a maximum of 200°F. This can be done on a hot plate or in an oven keeping the bearing off the bottom of the container so as to prevent overheating.

In our shop we also heat with an induction heater, making numerous checks to be sure the bearing does not overheat. We have applied hundreds of bearings by heating and can find no shortening of bearing life. Bearing manufacturers have booklets on bearing maintenance which are supplied free. One very good one is put out by the Anti-Friction Bearing Mfg.'s. Assoc. Inc., 60 E. 42 St., New York. The title is "Anti-Friction Bearing Maintenance", and the order number is AFBMA-100.—G.S.B.

ANSWER TO A29—Ball and roller bearings must be properly seated on the shaft if satisfactory service life is to be obtained. Bearings which are not squarely seated, which are not tight on the shaft, or which have been strained or damaged during application, will fail prematurely. With large sizes, there is always a hazard that a pressed-on bearing will have one of these defects, while a bearing that has been expanded with moderate heat will most likely seat properly without stress. And, in applying heat, induction heaters are least likely to damage the bearing.

Induction heaters are used exclusively in our shop for removing and applying traction motor bearings on diesel locomotives, and we have no record of a bearing failure which could be charged to their use. In fact, when emergencies arise that make it impossible to obtain an induction heater for bearing removal, we are forced to use a welding torch to heat the bearing in order to remove it. Naturally that bearing is unfit for further service, while the induction heated bearing will very likely be returned to service. From this it is apparent that induction heater use is good practice, and not to be feared.—D.H.N.

ANSWER TO A29—Excessive heating of the bearing will cause it to lose its temper, which condition is accompanied by a discoloration of the metal, usually a bluish color. When this happens the bearing should not be used. This does not mean that heating of the bearing should be avoided. Without question it is far superior to hammering the bearing on, since the condition of the bearing is never known when installed in this manner even when great caution is exercised. Rather than using a growler or magnetic induction to heat the bearing, it is far better to use a can of heated oil, since this method is cleaner. Do not bring the oil to a boil. A safe and adequate temperature is about 200 degrees F.—J.S.

What Type Of Motor?

QUESTION B29—Please explain the operation and type of a motor having nameplate data of 115-volt, single phase, 13 amps and 6 brush holders. The motor has forward and reverse directions.—J.B.K.

ANSWER TO B29—The type of motor which you have described appears that it might possibly be an ac series motor. Motors of this type have a wound rotor and commutator which is connected in series with the stator winding. Current reversals in the windings of this type of motor would be similar to the effect obtained by reversing the current flow through both armature and field of a dc motor in that the motor would still tend to rotate in the same direction and not reverse.

While still on the subject of reversing ac series motors, they are reversed in much the same manner as would be a dc motor—by reversing the current flow through either armature or field but not through both at the same time. The most convenient way to reverse your motor would be to shift

Unbelievable Time and Labor Savings!

Beaver's NEW "Speed-Cut" Abrasive Cut-off Machine No. 20

NOTE THESE TREMENDOUS TIME SAVINGS!

SIZE	MATERIAL	CUTTING TIME
2"	Steel Pipe	5 Seconds
4"	Cast Iron Soil Pipe	6 Seconds
6"	Steel Pipe	40 Seconds
2"	Cold Rolled Steel	20 Seconds
4 x 4 x 3/8"	Steel Angle	12 Seconds
4"	Steel Channel	10 Seconds
2"	Galvanized Pipe	5 Seconds

CAPACITY

No. 20 with 20" wheel . . . 6" pipe; 2½" solid stock
No. 14 with 14" wheel . . . 4" pipe; 2 " solid stock

ONE MAN CAN CUT MATERIAL FOR A LARGE CREW OF MEN!

BEAVER PIPE TOOLS
DANA AVENUE · WARREN, OHIO, U. S. A.
"55 Years of Highest Quality"

Write today for Bulletin No. AB55 and Prices on Beaver's New Abrasive Cutting Machines.

the brush holder plate which would accomplish the former in the previous statement. As the ac series motor has a poor speed regulation, for safety, it would be a good idea to have a load connected to it before attempting to operate it, a field rheostat connected to it or by means of a manual or automatic type of resistance motor starter. The field poles on this type of motor should be of laminated construction due to the presence of eddy currents on ac. These would tend to cause overheating; however, this type of motor could operate from either an ac or dc power source if need be. Heavy loads can be started with this type of motor but with an excessive load it will stall. —L.C.D.

ANSWER TO B29—The 115-volt, 13-amp single phase six brush holder reversible motor mentioned by J.B.K. is evidently one of two general types of motors. It is probably a series or repulsion type motor and the amperage rating indicates about 1 hp at full load and average temperature. Assuming that the motor is reversible by shifting the brushes, if the brush holder is moved through a space of about 90 degrees to reverse direction of rotation from full speed forward to full speed reverse, it is a series type motor. Operating characteristics of a series motor are: high torque and amperage at slow speed on heavy loads; low torque and amperage on light loads, and "run-away" characteristics on no load. If the motor reverses with full load torque when the brush holder is shifted about 5 degrees in the direction of reverse rotation, it is a repulsion type motor. It may be either a straight repulsion or a repulsion-induction, or possibly repulsion-start, induction-run. If it has "run-away" characteristics at no load, it is a repulsion motor. If it does not exceed synchronous speed but by a small percentage at no load, it is a repulsion-induction motor with a squirrel cage winding under the regular armature winding. If it is necessary to bring the armature to a complete stop before reversing, it is a repulsion-start induction-run motor. A motor of this type is equipped with a short-circuiting device actuated by centrifugal weights which, at about 75% full speed, converts the motor from repulsion to induction. This type motor has a stable running speed from no load to full load.—J.A.

Class 3 Poles for Overhead Lines

QUESTION C29—We have a number of overhead distribution lines

This could be you—"In the Land of No Distributors."

Imagine the chaos that would result if there were no distributors!

Conceivably, most of your day would be spent interviewing and sampling the wares of a constant stream of manufacturers' salesmen. How much easier—and more time saving to rely on your distributor salesman to keep you abreast of the thousands of different products he handles.

In addition, "in the land of no distributors"—

- **you would have to place orders all over the country and wait for erratic deliveries**
- **you would be forced to carry a tremendous inventory (and insure it)**
- **your "over-the-counter" purchases would be major headaches**
- **your order department and accounts payable department would have to be increased a hundredfold**

That's why dependable electrical manufacturers advise you to always buy from—

YOUR DISTRIBUTOR—THE BEST FRIEND YOUR BUSINESS CAN HAVE! He's the *one* source for *everything* electrical—and he's local.

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

Manufacturers of Arteries for Electricity, Liquids and Gases

WIRE • CABLE • CONDUIT • BRASS and COPPER TUBE • PLASTIC PIPE

MODEL 1191

TORK

"the complete line"

LIGHT AND POWER TIME SWITCHES

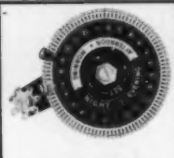
TORK'S Complete Line answers the Switching and Timing needs of any Light or Power application.

Only TORK provides all four necessary timing dials . . . illustrated below . . . for timing the switching of any electrical circuit. Moreover, TORK alone provides Astronomical and Seven Day Timing with popular priced Time Switches.

WRITE FOR BULLETIN #155

PLAIN DIAL
On and Off daily

ASTRONOMIC DIAL
On at Sunset



SKIP-A-DAY DIAL
Weekend or holiday cutout

SEVEN DAY DIAL
Different daily settings possible

PLAY SAFE-USE THE BEST

TORK CLOCK CO., INC. Mount Vernon, N. Y.

a new superior system of
CABLE and TUBING race ways
GLOBE'S CABLE WAY
Easy to Install
Saves Time
Saves on Material
Galvanized
No Maintenance problem
A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.
Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.
Write for new complete catalog.
Distributors in all principal cities.
Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.
THE GLOBE COMPANY
Manufacturers Since 1914
4000 S. Princeton Ave.
Chicago 9, Ill.
Globetray
PAT. PENDING
THE GLOBE COMPANY
CHICAGO 9, ILLINOIS

around our shop for which we were told to specify Class 3 poles. What, actually, is a Class 3 pole, and what determines the proper grade of pole to use?—D.H.N.

ANSWER TO C29—The basic considerations controlling the design selection of wood poles are based on the following requirements:

1. Required clearances to ground.
2. Span between poles.
3. Permitted sag.
4. Wire sizes and insulation, if any.
5. Anticipated windage and ice loadings.
6. Number of conductors per pole.

The last five factors determine the class pole or required strength which intermediate or dead end poles must possess under normal and abnormal operating conditions. To determine the horizontal loading of any pole, the following approximate relationship may be used: $T = \frac{S^2 \times W}{8 \times D}$

Where: "T" is the horizontal load in pounds for each conductor.
"S" is the span in feet between poles.
"W" is the weight in pounds per foot of conductor, including windage and ice loading.
"D" is the permitted sag in feet.

As an alternate method of determining horizontal loading, use any one of many aerial cable manufacturers' catalogs containing tabulated results of the above formula. The standard breaking loads of various classes of poles are listed below:

Class 1 pole	4500 pounds
Class 2 pole	3700 pounds
Class 3 pole	3000 pounds
Class 4 pole	2400 pounds
Class 5 pole	1900 pounds
Class 6 pole	1500 pounds
Class 7 pole	1200 pounds

A safety factor of two to three should be used with the above values. For any particular type of pole (Douglas Fir, Yellow Pine, Western Cedar, etc.), and any given length of pole, the class of pole will determine the circumference of the pole at the tip end and at the ground line. Further considerations in specifying wood poles should be:

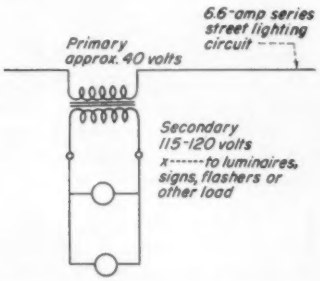
1. Creosoting or other preservative treatment.
2. Maximum permitted defects, such as knot sizes, cracks, crooks, degree of sweep, etc.—L.S.

ANSWER TO C29—Wood poles are classified into ten classes according to the circumference at the top of the pole and circumference at a point 6 ft. from the butt. However class sizes will vary with the various types of woods.

Suggest you borrow a copy of "American Electricians Handbook by Clifford Carr and published by McGraw-Hill, from your local library, for complete pole specifications. As to what determines the class of pole to use, it is usually governed by load and height of pole and possible local ordinances which sometime regulate height and size for clearance over streets, buildings, etc.—G.H.M.

Can you ANSWER these QUESTIONS?

QUESTION N29 —We have a great many series-multiple transformers which are used to connect small loads to 6.6 amp series street lighting circuits as shown in the accompanying sketch.


6.6-amp series street lighting circuit
Primary approx. 40 volts
Secondary 115-120 volts
to luminaires, signs, flashers or other load

There is a sharp difference of opinion as to procedure when removing the multiple load but leaving the transformer connected in the series circuit. Some say just to tape up the ends of the multiple winding. Others say they should be short-circuited like an instrument current transformer.

The transformers are made by a number of different companies and range from 400 watts to 2 kw.

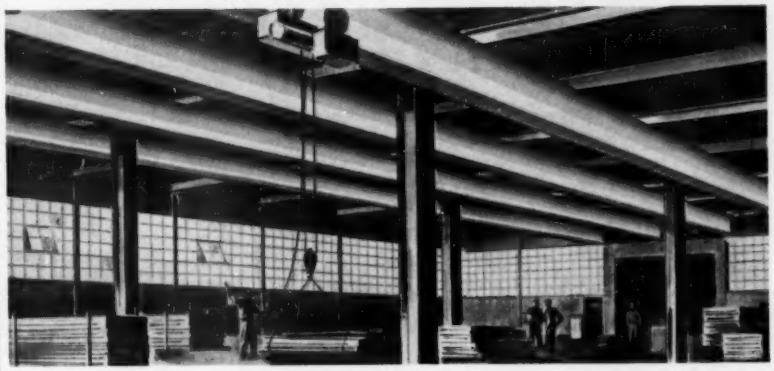
I would like some opinions, with reasons.—J.H.B.

QUESTION P29 — After a motor stator was cleaned of its winding and the nameplate removed, would it be possible to determine whether it had been a delta or star connection? The wire and coil size can be taken from the removed coils. Is there any reference book which deals mainly with winding of motors, also including sizes of wire and number of turns to use on the different motors?—E.H.

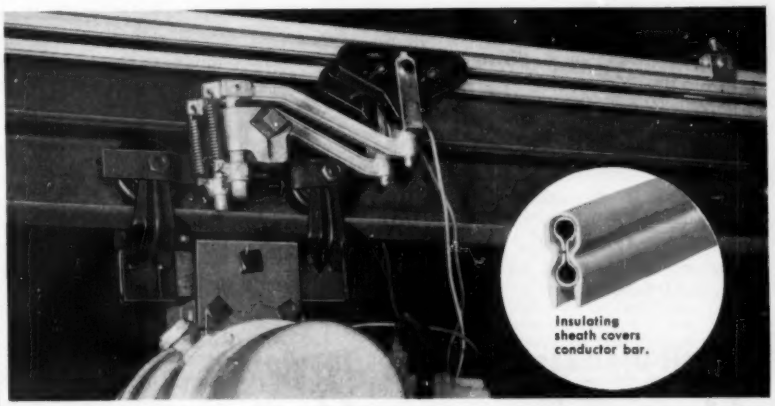
QUESTION Q29—Where is an isolation transformer used and under what applications is it required by the Code? —R.A.M.

PLEASE SEND IN YOUR ANSWERS BY JANUARY 15

BEWARE this Danger Zone



BE SAFE with Insul-8-Bar



MOBILE SAFETY ELECTRIFICATION FOR CRANES · MONORAILS · ALL MOVING MACHINERY

DON'T BE SHOCKED by bare conductor accidents. Protection is now provided by low cost Insul-8-Bar enclosed conductor systems.

Safety insulation is coupled with simplicity. The basic system consists of insulated 8-bar conductors and sliding shoe collectors.

VERSATILE, TOO. Standard parts eliminate the need for costly, special engineering (e.g. factory fabricated curves are never required.)

Conductors can be placed as close as 1¼" centers — side by side, horizontally or vertically. Available in capacities of 50 to 500 amperes.

These are the only systems that meet all requirements of crane, monorail and mobile machine electrification.

For low cost safety and trouble-free performance, insulate with Insul-8-Bar. Write for catalog and technical data.

INSUL-8-CORP.,
1369 Industrial Road, San Carlos, Calif.
Representatives In All Major Cities

INSUL 8 CORP.

Questions on the Code

Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*

GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*

B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Wiring A Farm House

Q. *Would it be permissible to install a second 60-amp service complete with three No. 6 SEU service conductors adjacent to the first switch in a rural home when it becomes necessary to increase the capacity in that farm home?—K.P.*

A. No, under Section 2301 it would be impossible to set two service switches with two separate service drops in any dwelling unless one of those services was used for a special class of use. In other words, if it supplied only a water heating load or a cooking load and no other loads, it would then be considered permissible by the Code. Under paragraph a. of Section 2351 you will note that it would be permissible to set two 60-amp service switches supplied by a single service drop in a dwelling provided the switches were mounted adjacent to each other, because under this rule in the code permission is granted to have up to six separate manual operations necessary to disconnect the electrical supply to an individual building.—G.R.

Small Diameter Wires

Q. *For new installations we are allowed to install more small diameter wires in surface raceways than is permitted for conduit and EMT. Why is this permitted?—H.S.*

A. I don't believe I have a definite answer to this question. Yes, it is true that we are permitted to take advantage of the smaller diameter of the wire for new work if these smaller diameter conductors are installed in surface metal raceway.

For example, the listing for the H & B Enterprise Corp. shows an approval for four No. 14 Type R or RH conductors, or eight No. 14 Type T, TW or RU conductors. Similarly for National Electric Products Corp. No. 333 we may install two No. 6 wires Type T or RU but are not permitted to install any No. 6 wires of Type R or RH. Wiremold Co. No. 3000 will permit six No. 6 Type R or RH or eight No. 6 Type T or RU. And this advantage for the "thinner walled" conductors will be found throughout the entire listing of these raceways.

Conduit or EMT may be concealed and/or exposed for any installation. Surface metal raceways, with the one exception for underplaster extensions, is always exposed. For economical reasons complete installations with surface metal raceways are not likely to be made, although some very extensive systems have been installed. In general, where a rewiring job has to be done to obtain increased capacity, with surface metal raceway already installed on the job, it is a relatively simple job to install the additional circuits in new surface metal raceways. Seemingly, for consistency, a special rule should be applied for those cases where all the conduit and EMT is run exposed on a particular job.

Maybe this discussion will evoke from some of our readers a better explanation as to why surface metal raceways seem to enjoy this advantage over conduit and EMT with respect to the greater fill of the smaller diameter wires in these surface metal raceway systems.—B.Z.S.

Insulation

Q. *On a 3-wire single-phase 115/230 volt service used to supply multi-wire circuits, is it necessary to use different colored insulation on the two ungrounded conductors?—B.D.*

A. Yes, the Code under Section 2112 specifies that a 3-wire circuit contain one black, one white and one red conductor. Furthermore, under this same section the last sentence reads as follows: "All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation." Many inspectors do not necessarily require that the specific colors referred to in the Code be used. However, most inspectors do require the use of different colors on the ungrounded conductors and that the same colors be used on all conductors connected to the same ungrounded feeder conductor.—G.R.

E.M.T. In Hazardous Location

Q. *Section 5014-b of the Code recognizes the use of electrical metallic tubing in a Class 1, Div. 2 hazardous location provided it is threaded and conforms to Section 3487. Section 3482 covering the use of E.M.T. says it cannot be used in a hazardous location except as otherwise provided in Article 500. Section 3487 advises that E.M.T. shall not be coupled together nor connected to boxes etc., by means of threads in the wall of the tubing, except by fittings approved for the purpose. Will you unravel these statements and advise, more specifically, the conditions under which E.M.T. may be used in a Class 1, Div. 2 location.—L.T.*

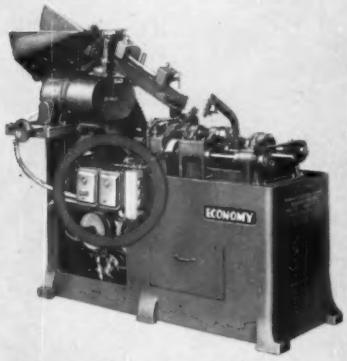
A. A brief review of the Code history indicates that electrical metallic tubing was first recognized for use in a Class 1, Div. 2 hazardous occupancy under 5014-b in the 1947 Code. At that time no reference was made to the provisions for threads as covered in Section 3487 and it appears that boxes or fittings having openings specially designed to receive the tubing could be used without a bonding jumper and no threads would be required on the tubing. This provision continued unchanged in the 1951 Code but in the 1953 Code the use of E.M.T. in a Class 1, Div. 2 location became subject to the provisions of Section 3487 and Section 5014-b specifically required that the tubing must be threaded.

Section 3482 covering the use of E.M.T. has recognized the use in a hazardous location since 1947, as covered by Section 5014-b and the same provision is included in the 1953 Code.

The use of threaded E.M.T. has been recognized since 1947 by Section 3487. This provision however restricts this procedure to special threads in the wall of the tubing and fittings, connectors etc., which are approved for the purpose. This requirement is significant in view of the thin wall of the tubing and the importance of obtaining a connection which is adequate to prevent arcing. As I recall, the Briegel Tool Company developed tools

A-B explosion-proof solenoid starter on liquid petroleum gas compressor.

A-B Bulletin 609 manual starter on Barnesdril magnetic and fabric filter.



A-B solenoid starters and 3-button station on Economy shaving machine.

A-B Bulletin 709 solenoid starter on Oliver 36 inch, 5 hp band saw.

Bulletin 609 manual starter showing overload breakers

Bulletin 709 automatic solenoid starter

Bulletin 712 combination starter with fuses and disconnect

3 MOST POPULAR MOTOR STARTERS

These three across-the-line starters are so popular because each is a QUALITY product in design and construction, which provides continuously accurate and reliable thermal overload protection. Costly motor burnouts are prevented and machine shutdowns are avoided.

Bulletin 609 Manual Starters

Because these starters are push-button operated, they can be mounted in close groups if necessary. Switching mechanism is both "quick make" and "quick break." Sustained overload trips the starter and stops the motor. The overload breakers are reset by pushing the STOP-RESET button. Available up to 5 hp, 220 v; 7½ hp, 440-550 v.

Bulletin 709 Solenoid Starters

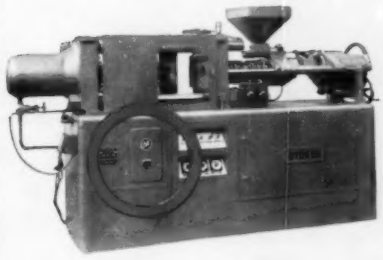
The simple design—only one moving part—of these remote control automatic starters assures long life and trouble free operation. Provide reliable motor overload protection. They also give no-voltage release protection that prevents the accidental restarting of stalled motors. The operator must press the START button to restart the motor. Available in ratings up to 300 hp, 220 v; 600 hp, 440-550 v.

Bulletin 712-713 Combination Starters

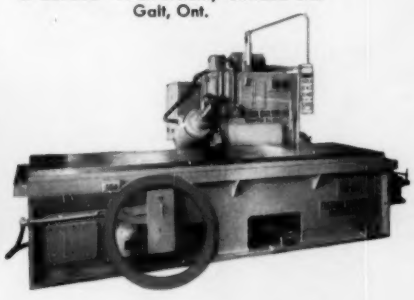
These compact starters save space and installation cost by combining magnetic starter and manual visible blade disconnect or circuit breaker in a single cabinet. This assures a neat, safe installation, because starter cabinet cannot be opened unless disconnect lever is in the "OFF" position. Available with manual disconnect up to 100 hp, 220 v; 200 hp, 440-550 v. With circuit breaker up to 200 hp, 220 v; 400 hp, 440-550 v.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

In Canada—Allen-Bradley Canada Ltd.
Galt, Ont.



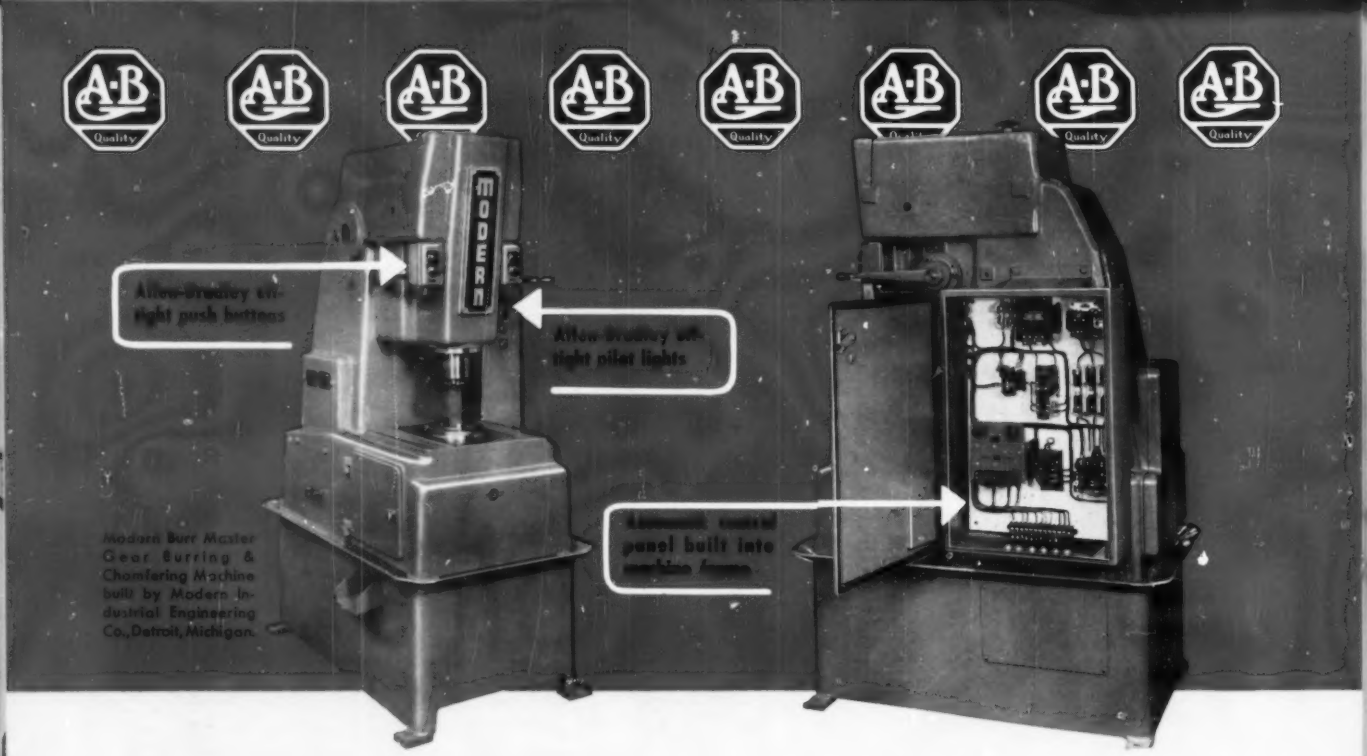
A-B flush-type Bulletin 709 starter on Stokes injection molder.



A-B Bulletin 712 combination starter on Ekstrom-Carlson scarf mill.

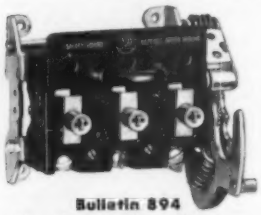
10-55-MR

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

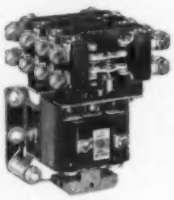

Allen-Bradley oil-tight push buttons
Allen-Bradley oil-tight pilot lights
Modern Burr Master Gear Burring & Chamfering Machine built by Modern Industrial Engineering Co., Detroit, Michigan.
panel built into

How to Build Trouble Free Automatic Control Panels

ALLEN-BRADLEY PANEL COMPONENTS



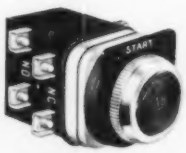
Bulletin 894
Manual Visible Blade Disconnect



Bulletin 700 Universal Relays up to 8 poles a-c or d-c

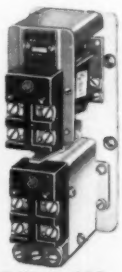
Bulletin 891
Adjustable Fuse Clips

Bulletin 800T Oil-tight Pilot Light with glass lens

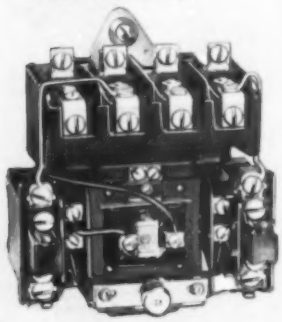


Bulletin 800T Oil-tight Push Button

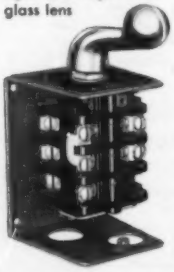
Bulletin 800T Oil-tight Push Buttons



Bulletin 849
Pneumatic Timer



Bulletin 709
Solenoid Starter



Bulletin 350
Drum Switch

Special control panels—to be reliable and trouble-free—must be built of reliable starters, relays, timers, indicating pilot lights, etc.

When you standardize on the Allen-Bradley line of control components, you get the benefits of years of practical experience with all types of control problems. But, best of all, let Allen-Bradley design and build your trouble free panels for you. Call your nearest Allen-Bradley office for friendly counsel.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd.
Galt, Ont.

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

16-35-MR

for threading and special fittings which satisfied this Code provision.

Under Section 93481-c, construction specification, threaded E.M.T. has been recognized in the Code since 1947. Previously it was not so recognized.

The present provisions of the 1953 Code which requires threaded E.M.T. when used in a Class 1, Div. 2 location was the result of field experience which indicated that the threadless connections of compression and other types would not assure electrical continuity sufficiently adequate to assure non-arcing paths to ground.

With this background, the Code definitely recognizes the use of E.M.T. in a Class 1, Div. 2 location provided all connections are threaded by the use of special dies, and special fittings approved for the purpose are used.—B.A.McD.

Fixture Wire

Q. *My attention was called today to an ad for a new recessed type fixture, advertising the use of Type SF 1 fixture wire and in going through my copy of the 1953 Code, I can find nothing on this type of fixture wire. Is this material suitable and will it comply with the Code if it is used?—D.S.*

A. Interim Amendment 103 has been released by the National Electrical Code Committee recognizing the new silicone insulation fixture wire. This Interim Amendment became effective August 17, 1955 and recognizes Type SF 1 wire as being suitable for fixture wiring where it is limited to 300 volts, giving it a maximum operating temperature of 200 degrees centigrade or 392 degrees Fahrenheit, and SF 2 wire as being capable of operating with the same maximum temperatures but suitable for either fixture wire or for use as outlined under Section 3103. In other words, it is approved for use for flexible cords, as control wires for printing presses, for controls on cranes or hoists, elevators, signal circuits, for machine tool wiring in addition to being approved as a fixture wire. Then in addition to this, they have an SFF 1 and an SFF 2. These latter two types of insulation are approved for use under maximum operating temperatures up to 150 degrees Centigrade or 302 degrees Fahrenheit, the SFF 1 being limited to fixture wiring where the voltage is not in excess of 300 volts and the SFF 2 being approved as SF 2 for various types of wiring.—G.R.

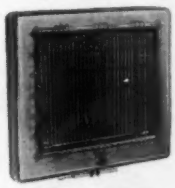
ELECTROMODE
WORLD'S MOST COMPLETE LINE
√ All-Electric HEATERS
√ Electric HEATING SYSTEMS

100% SAFE
Only ELECTROMODE has the sealed-in CAST-ALUMINUM HEATING ELEMENT. No danger of fire, shock or burn. Guaranteed for 5 years. Built-in safety switch prevents overheating.
Approved by Underwriters' Laboratories.

For More Than A Quarter Century Electromode Has Specialized in One Specific Industry

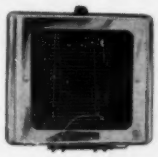
HEATING BY ELECTRICITY
ALL YOUR REQUIREMENTS
FROM ONE RELIABLE SOURCE

Safest TO USE.... *Easiest* TO INSTALL



PANEL HEATER
Combines principles of radiant and convection heating. Unbreakable (no glass or ceramics). 1100 watts, 120 or 240 volts.

- Automatic
- Fan-Circulated Heat
- Capacities For All Size Rooms



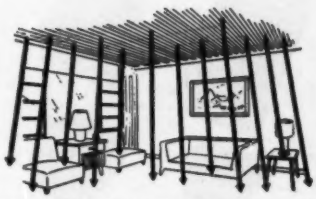
MODEL WJA
Wall-type Bathroom Heater

MODEL WA
Wall-type Down-flo Heater

BASEBOARD HEATER

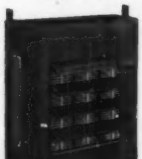
Low-Level Perimeter Heat spreads a shield of comfortable warmth against cold walls from floor to ceiling.
Basic Unit: 32" long, 8½" high, 3" wide, 600 watts, 120 or 240 volts. Blank sections, end-pieces and corners available so that an unbroken baseboard effect may be carried out in any size room.

CEILING *Radiant* CABLE HEAT



Electromode Heating Cable installed in ceiling radiates clean, sunlike heat downward. Has Magic Seal coating which prevents streaks on ceiling when cable is embedded in plaster. Automatic temperature control by separate thermostat for each room.

ELECTROMODE UNIT HEATERS
Solve HARD-TO-HEAT AREAS
in the PLANT and ISOLATED LOCATIONS
Easy to Install
No Plumbing Required



Suspension Type
10,000 to 45,000 watts 34,150 to 153,675 BTU

Portable and Suspension 1,500 to 7,500 watts 5,122 to 25,613 BTU

Safe HEAT for HAZARDOUS AREAS

Explosion-Proof
2000, 4000, 6000 watts 6830 to 20,490 BTU

Conform to rigid safety specifications and are fully tested and approved for use in areas covered by Class 1, Group D.

ELECTROMODE CORPORATION Dept. EC-125
45 CROUCH STREET, ROCHESTER 3, N. Y.

Send us FREE Electric Heating File, containing specifications, illustrations, installations, prices and how to figure electric space heating. We are interested in:

Name.....
Address.....
City..... Zone..... State.....

☐ Home and Office Heaters
☐ Industrial Unit Heaters
☐ Explosion-Proof Heaters

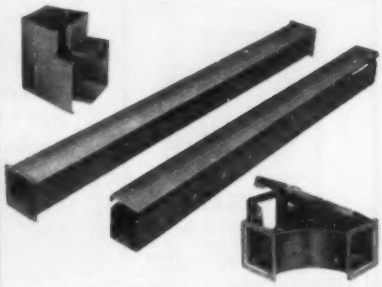
You can do a good job easier
(and more profitably, too!) with the

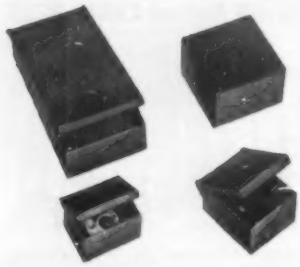
KEYSTONE
QUALITY LINE

WIREWAYS AND FITTINGS · CUTOUT AND PULL BOXES
SWITCH BOXES · OUTLET BOXES · BAR HANGERS

Next time you're figuring a wiring job, specify "Keystone" all the way! You'll find the line includes most of the items you'll need for a neat, efficient, practical installation . . . all quality built, all competitively priced. All "job-engineered" to save you time, reduce your costs, increase your profits per job!

KEYSTONE WIREWAYS and Auxiliary Fittings have all the time-saving, money-saving features your customers want. They're quickly, easily installed, readily adaptable to any power distribution system. Available, too, in both flanged and flangeless styles and a wide range of sizes and lengths . . . from 2½" x 2½" x 1 ft. through 8" x 8" x 5 feet long.





KEYSTONE CUTOUT BOXES and Pull Boxes are furnished in Type "A" with hinged cover, Type "SC" with screw cover. Both feature a formed construction strongly fabricated and securely welded . . . with adequate, easily removable knockouts. And both types are available in a complete range of sizes . . . stocked for prompt delivery to meet your needs.

KEYSTONE SWITCH BOXES and Outlet Boxes are loaded with extra quality features! BX or Romex clamps are already assembled with nested fit for easy pulling of wires. Knockouts and pri-outs come out double quick. And tapped holes are extruded to provide extra thickness, eliminate stripping of threads. Even mounting brackets make installation easier.

New fact-filled, illustrated catalog presents the complete Keystone Quality Line . . . send for your free copy today!

It pays to figure on Keystone

KEYSTONE MANUFACTURING COMPANY
23328 SHERWOOD AVENUE • CENTER LINE (Detroit) MICHIGAN

. . . the Complete Line of Wiring Installation Equipment
Sold Only through Recognized Electrical Distributors

Comment—Operating Room Fixtures

The following question on fixtures for hospital operating rooms appeared in the September issue of E. C. & M:

"Q. We understand an Official Interpretion of lamp surface temperatures as required by Section 5019b2 and as applicable to hospitals by rule 5136c1, limits the lamp size to 150 watts. Does that mean a fixture designed as an operating light, suspended from the ceiling with a 350-watt lamp is a violation?—R. E. C."

Section 5135-d(3) of Article 510 of the 1953 National Electrical Code reads as follows:

"Ceiling suspended surgical and other lighting fixtures shall conform to paragraph b, Section 5109 of Article 500".

Section 5019-b(2) states: "If lamps are of a size or type which may, under normal conditions, reach surface temperatures exceeding eighty per cent (80%) of the ignition temperature of the gas or vapor involved as determined by ASTM test procedure (Designation D286-30) fixtures shall conform to sub-paragraph a.1 of this section."

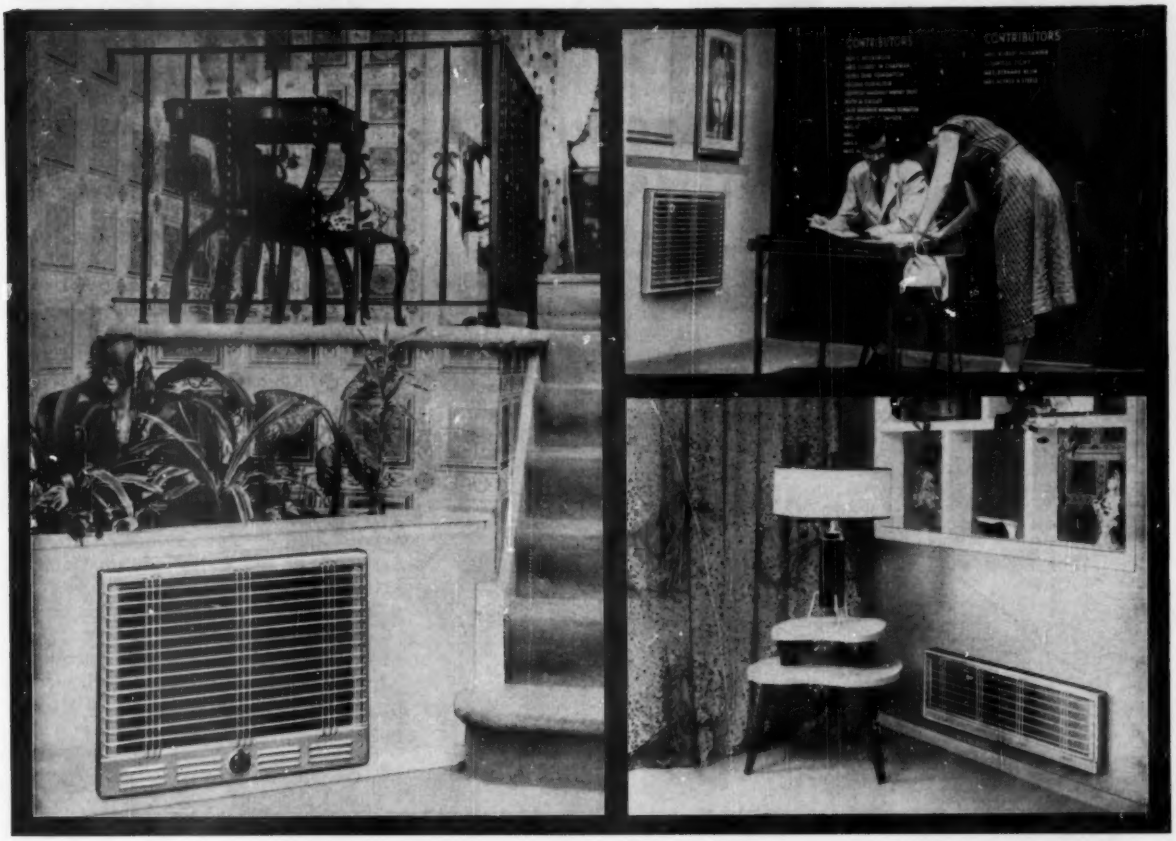
In other words, explosion-proof lighting fixtures are required if the temperature of the lamp bulb exceeds 80% of the ignition temperature of ethyl ether. The ignition temperature of ethyl ether is 180°C (356°F). 80% of this is 144°C (291°F).

Few people realize the high operating temperature of Mazda lamps. The following tabulation of open lamps (not enclosed in fixtures) has been provided to us by Nela Park and Westinghouse Lamp Company:

Watts	Bulb Size	Volts	Maximum Bulb Temperature of Open Lamp
100	A-21	120	261
150	PS-25	120	290
200	PS-30	120	307
300	PS-30	120	374
500	PS-40	120	389

It can be seen from the above table that all the open lamps from 150 watts and up exceed the 80% temperature limitation which is 291° for ethyl ether. There is no doubt that enclosed fixtures would further increase the lamp temperature and that explosion-proof fixtures would be required for 150-watt or larger lamps.

This matter was discussed by Code Panel No. 14 and they have suggested a proposed amendment 34 reading as follows: "In 5135-d(3), change the period at the end of the sentence to a comma, and add the following: 'except that surface temperature limitations set forth in sub-paragraph b-2 of that section shall not apply.'" —R. W. Scott, Crouse-Hinds Co.



Installation photographs courtesy of Berko Electric Manufacturing Corp.

You can recommend this radiant heat panel confidently

The wall-mounted heating units illustrated above are made and sold by the Berko Electric Manufacturing Corp., Queens Village, N. Y. Owners of such Berko heaters are enthusiastic about the comfort, convenience and safety they provide.

The heating elements in these heaters are PYREX Radiant Glass Panels. You can expect your customers to have confidence in any heater you may recommend with a PYREX panel heating element, as they are already familiar with other PYREX brand products having excellent heat-resistant qualities.

PYREX Radiant Panels are made of heat-resistive glass with an electrically conductive coating inseparably bonded to the entire back surface. Thin silver strips bonded to opposite edges of the panel distribute the current *evenly* over its entire length and breadth. This provides completely uniform heat radiation.

Efficient

PYREX Radiant Panels radiate about double the heat of a metal-finish radiator at the same operating temperature. This high degree of efficiency helps bring the cost of electric heat within reach of more homeowners. Also, there is little initial surge of current when these panels are turned on—another point of economy.

The coated side of the panel itself acts as a heat reflector. With the addition of a metal reflector, as much as 80% of the input energy is available as heat radiation from the panel's uncoated side.

At 400°F. over 75% of the panel's heat energy is emitted in wave lengths of four microns and longer. This energy provides instant warmth and comfort.

Customer benefits

PYREX panels provide clean, draftless heat and the panels themselves are easy to wipe clean. Free dust particles will not adhere to or carbonize on them. In-the-wall installation leaves completely free floor space and installation is easy. There's space saved, too, because there is no heating room. Every room is individually thermostatically controlled. The glass is high in physical strength. It's safe and durable.

For additional technical information on PYREX Radiant Panels, write, wire or phone.

CORNING GLASS WORKS, CORNING, N.Y.
912 Crystal Street
Corning means research in Glass

Amazing Time Savers

FOR PIPEFITTERS • ELECTRICIANS PLUMBERS • MAINTENANCE MEN

New Millers Falls Deep-Cut Hole Saws

cut through

METAL
PIPE
WOOD
PLASTER

any machinable material

Save time. Save work. These rugged new hole saws will speed up countless jobs for you. With a special *high speed steel* cutting edge welded to a tough chrome-vanadium body, they bite through practically any material.

You can use them to cut into metal pipes and tanks — or for boring holes fast in walls, floors and partitions. They go through wire nails, screws, metal lath and most other metal obstructions without damage to their sharp cutting teeth.

Depth of cut is a full 2½". And, since these saws can follow through the holes they make, you can cut to almost any depth by removing the core as you go along. Good chip clearance, so necessary for rapid cutting, is assured by the spiral elevator groove in the body of the saw.

Get a set of these remarkable new Millers Falls Deep Cut Hole Saws. They come complete in the compact steel carrying case shown above — 6 saws from 1 1/16" to 2 9/16" diameter, plus 2 mandrels with ⅜" pilot drills. Buy yours today. They'll pay you back fast in the time and work they save.

SEE THEM AT YOUR SUPPLIER TODAY

Write for catalog of Millers Falls Tools

MILLERS FALLS COMPANY
Dept. EC-2, Greenfield, Mass.

MILLERS FALLS TOOLS
SINCE 1868

Number Receptacles on Appliance Circuit

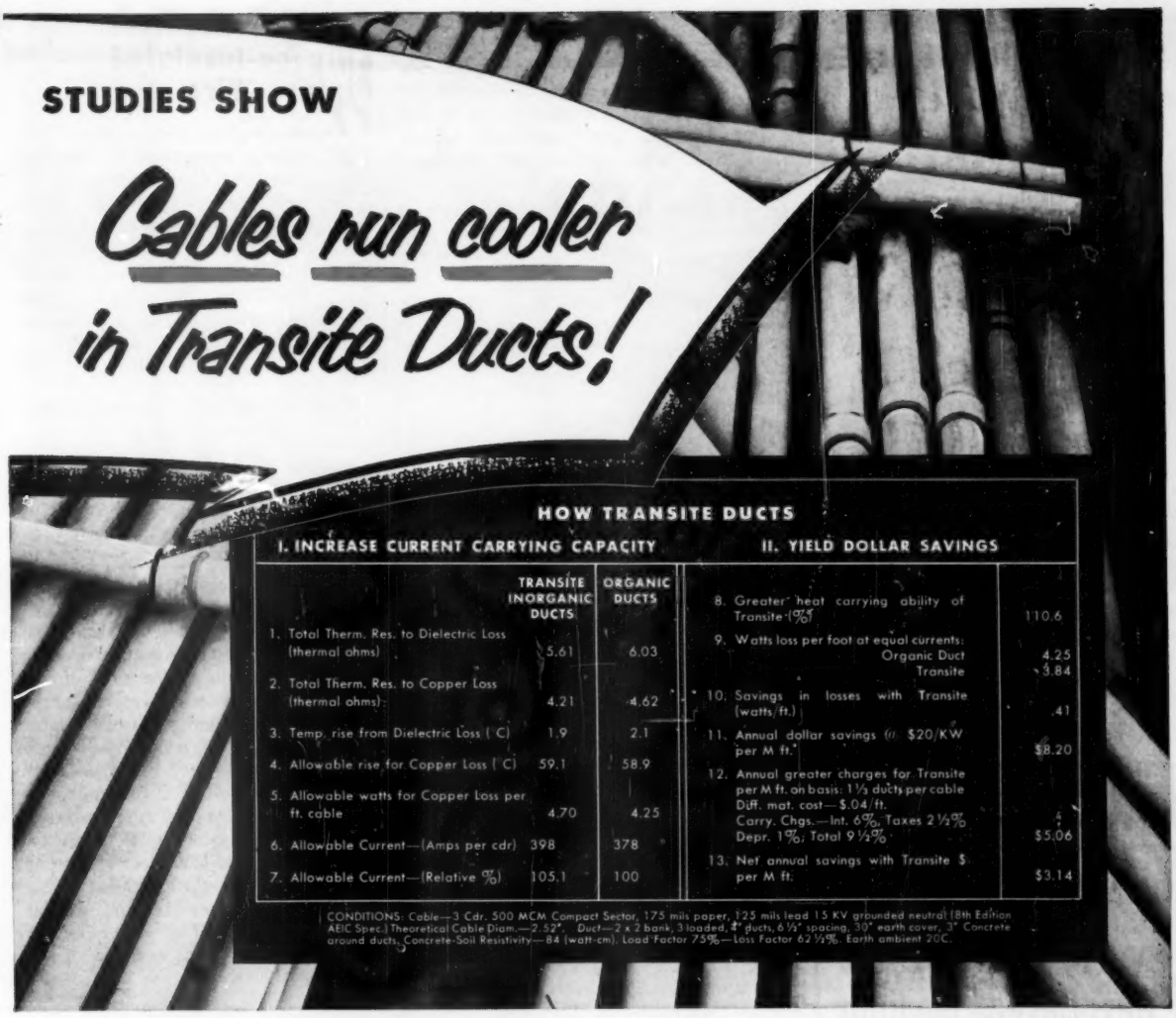
Q. *What is the correct method according to N.E.C. for determining the maximum number of convenience outlets to be attached to one appliance circuit (reference 2115 Par. b) in a residential occupancy? Also, is there any reference other than 2115 b, in your opinion, as to the minimum number of small appliance circuits in a one family dwelling occupancy?*

We would also be most grateful to you if you would write us an opinion, and outline for us, the correct procedure to follow in order to get as rapid an interpretation as possible from the Code committee.—P.J.D.

A. I do not believe that Section 2115 b or any other section of the Code definitely limits the number of receptacle outlets that may be placed on the small appliance circuit required in a residential occupancy. In the ordinary dwelling, there must be at least one 20-amp branch circuit and according to Section 2124-a there must be one receptacle outlet provided for every 20 linear feet or major fraction thereof of the total (gross) distance around the room. The wording "one or more" appliance branch circuit indicates that the Code anticipates conditions where two or more such circuits should be installed. In some parts of our country, several inspectors, on the basis of this wording, are requiring a minimum of two appliance branch circuits in an ordinary residential occupancy. A proposal was discussed by the Electrical Committee in 1952 that would require a minimum of two branch circuits and it is now under consideration for the 1956 Code.

Section 2116-a-2 of the Code limits the number of receptacles on a branch circuit by requiring each outlet to be figured at 1.5 amps per outlet. The fine print note following this provision advises that this requirement does not apply to the receptacles on the appliance circuit covered by Section 2115-b. In 1952 a proposal to limit the number of receptacles on such circuits to four was presented and rejected by the Electrical Committee.

The provisions of the first paragraph of Section 2115-a calls our attention to the fact that appliances, other than the small appliances covered in paragraph b of Section 2115 must be considered as provided in Section 2116, and the second paragraph of Section 2115-a indicates that any branch circuit must be of a



STUDIES SHOW

Cables run cooler in Transite Ducts!

HOW TRANSITE DUCTS

I. INCREASE CURRENT CARRYING CAPACITY

	TRANSITE INORGANIC DUCTS	ORGANIC DUCTS
1. Total Therm. Res. to Dielectric Loss (thermal ohms)	5.61	6.03
2. Total Therm. Res. to Copper Loss (thermal ohms)	4.21	4.62
3. Temp. rise from Dielectric Loss (°C)	1.9	2.1
4. Allowable rise for Copper Loss (°C)	59.1	58.9
5. Allowable watts for Copper Loss per ft. cable	4.70	4.25
6. Allowable Current—(Amps per cdr)	398	378
7. Allowable Current—(Relative %)	105.1	100

II. YIELD DOLLAR SAVINGS

8. Greater heat carrying ability of Transite (%)	110.6
9. Watts loss per foot at equal currents: Organic Duct	4.25
Transite	3.84
10. Savings in losses with Transite (watts/ft.)	.41
11. Annual dollar savings @ $20/KW per M ft.	$8.20
12. Annual greater charges for Transite per M ft. on basis: 1⅓ ducts per cable Diff. mat. cost—$.04/ft. Carry. Chgs.—Int. 6%, Taxes 2½% Depr. 1%; Total 9½%	$5.06
13. Net annual savings with Transite $ per M ft.	$3.14

CONDITIONS: Cable—3 Cdr. 500 MCM Compact Sector, 175 mils paper, 125 mils lead 15 KV grounded neutral (8th Edition AEIC Spec.) Theoretical Cable Diam.—2.52". Duct—2 x 2 bank, 3 loaded, 4" ducts, 6½" spacing, 30" earth cover, 3" Concrete around ducts. Concrete-Soil Resistivity—84 (watt-cm). Load Factor 75%—Loss Factor 62½%. Earth ambient 20C.

—and copper losses are reduced . . . current capacity is increased . . . insulation life prolonged

TESTS have been made for many years by the Johns-Manville Research Center, to determine how Transite Ducts improve the dissipation of heat by conductors under load. The application of the test results is summarized above.

The figures prove that Transite Ducts will carry heavier current loads than organic ducts when sheath temperatures are the same. The result is a cooler cable under a given load . . . lower I^2R losses . . . longer insulation life from lower operating temperatures.

Transite Ducts offer many other advantages, too. Made of asbestos-cement, they are incombustible, resistant to corrosion, unaffected by electrolysis. When arcing occurs, Transite protects adjacent cables from damage. These durable, light-weight ducts provide complete and permanent cable protection, together with savings on installation and maintenance.

For complete details on these tests and the many advantages of Transite Ducts, write for free copy of Brochure EL-29A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

JM PRODUCTS

Johns-Manville TRANSITE DUCTS

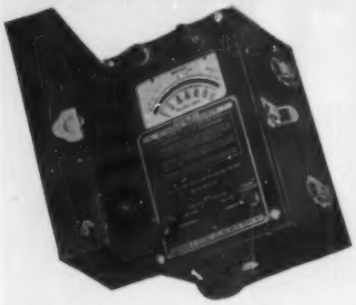
TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

A REALLY USEFUL SERVICE INSTRUMENT!

4 METERS IN 1

NEW MODEL B-6 MEGOHMER



❶ **Insulation Tester,** 0-200 megohms, 500 volts DC test potential. With exclusive triple-color grading scale.

❷ **Ohmmeter,** 0-2000 ohms.

❸ **AC Voltmeter,** 0-150/600 volts.

❹ **DC Voltmeter,** 0-150/300 volts.

Full details in Bulletin 441

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK 7, N. Y.

Two New Minerallac Quality Products Designed for Jobs Too Heavy for Standard Jiffy Clips

MINERALLAC Hevi-Duty AND Medium JIFFY CLIPS

Also available without mounting hole for use with gun.

patent pending

Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler

SEND FOR LITERATURE

MINERALLAC ELECTRIC COMPANY

25 North Peoria St. Chicago 7, Ill.

MINERALLAC

size sufficient for the actual load to be served. I believe these provisions indicate that all types of appliances found in some residential occupancies today are not intended to be served through the small appliance branch circuit. In my opinion such a circuit is only designed to serve portable appliances such as electrical toasters, flatirons, refrigerators, coffee percolaters, mixers, vacuum sweepers and other small appliances that are common to residential occupancies where the diversity in use and the time element promote a reasonably safe usage. For such loads the question of the number of receptacles is one of convenient use rather than overloading. Field experience indicates however that the original intent of this rule has been badly distorted. I do not believe we can classify most roasters, heaters or ironing-machines as small appliances. They usually require circuits of their own, and I believe the misapplication of the present rule is the reason why so many inspectors advocate the change in the present minimum provision.

The procedure to be followed in obtaining an Official Interpretation is covered on pages 362 and 363 of your 1953 Code. Your application should be addressed to M. M. Brandon, Chairman of the Electrical Correlating Committee, National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass. Five copies of your application must be supplied the chairman. Other details are covered in your Code.

N.E.C. Recognizes Silicone-Insulated Fixture Wire

Silicone-insulated fixture wire, Type "SF", is now recognized by the National Electrical Code. Approval became effective August 17, 1955 through release of Interim Amendment No. 103 by the National Electrical Code Committee of the National Fire Protection Association. The amendment makes appropriate changes in N.E.C. Sections 3102, 4144, 93101E and Table 3 of Chapter 10.

Text of Interim Amendment No. 103

Interim Amendment No. 103 makes changes in the code sections noted in the table below.

Release of this amendment to the 1953 edition of the National Electrical Code is in accordance with NFPA policy of keeping its standards up to date to furnish guidance in proper installation of equipment and safeguarding of hazards in furtherance of the general Association objective to reduce loss of life and property by fire. The amendment, developed under the published Procedure for Tentative Interim Amendments, is recommended by the Committee for application in the administration of the 1953 edition of the N.E.C. and is subject to further consideration by the National Electrical Code Committee and official action by the NFPA in connection with the next general revision of the National Electrical Code.

1. Add to Section 3102 (in the Table) the following:

Trade Name	Type Letter	Max. Operating Temperature	Special Provisions
Silicone Rubber Insulated Fixture Wire	SF-1	200° C 392° F	Fixture wiring limited to 300 V
Solid or 7 Strand	SF-2	200° C 392° F	Fixture wiring, and as permitted in Section 3103
Silicone Rubber Insulated Fixture Wire	SFF-1	150° C 302° F	Fixture wiring limited to 300 V
Flexible Stranding	SFF-2	150° C 302° F	Fixture wiring, and as permitted in Section 3103

2. In Section 4144 add Type SF following Type AF in the first sentence. Also add Type SF following Type AF in the second sentence.
3. Add to the Table in Section 93101E, under construction specification, the following:

Trade Name	Letter	Insulation	Thickness of Insulation	Outer Covering
Silicone Insulated Fixture Wire	SF-1	Silicone Rubber	18—1/64	Non-Metallic Covering
Solid or 7 Strand	SF-2	Silicone Rubber	18-14—1/32	Non-Metallic Covering
Silicone Insulated Fixture Wire	SFF-1	Silicone Rubber	18—1/64	Non-Metallic Covering
Flexible Stranding	SFF-2	Silicone Rubber	18-14—1/32	Non-Metallic Covering

4. In Table 3, Chapter 10, add in the last column: Silicone Rubber Types SF-1*, SF-2*, SFF-1*, and SFF-2*.

Line patrol. The Universal 'Jeep' carries patrol and service crews and equipment along the right of way to structures in off-road locations. It travels in conventional 2-wheel drive at highway speeds, but shifts easily into 4-wheel drive for extra traction to go through mud, soft earth, sand or heavy brush—or climb steep grades—where other vehicles can't go.

How 'Jeep' vehicles cut costs on construction and service jobs

Maintenance. The 4-wheel drive 'Jeep' Truck takes repair crews and equipment wherever they're needed, on or off the road. With the extra traction of its 4-wheel drive, it gets through to trouble spots when storms or other emergencies knock out service.

Trenching. The 'Jeep'-propelled trencher digs up to 800 feet of clean-cut 6-ft. deep trench per hour, to speed the installation of cable, conduit and service lines. Unit travels at highway speeds between jobs.

From line installation through maintenance and other service activities... the electrical industry is served on job after job 24 hours a day by 4-wheel drive 'Jeep' vehicles.

With the extra traction of their 4-wheel drive, 'Jeep' vehicles take crews and equipment off the road, right to the tower or substation, wherever service is required.

'Jeep' vehicles with power take-off operate a wide range of equipment, including generators . . . compressors . . . mowers . . . post hole diggers . . . winches . . . and many more.

Learn how the electrical industry uses multi-purpose 'Jeep' vehicles for hundreds of different jobs, from installing meters to stringing high lines, and how these vehicles save owners money through long life and low maintenance costs. See your Willys dealer today, or write for information.

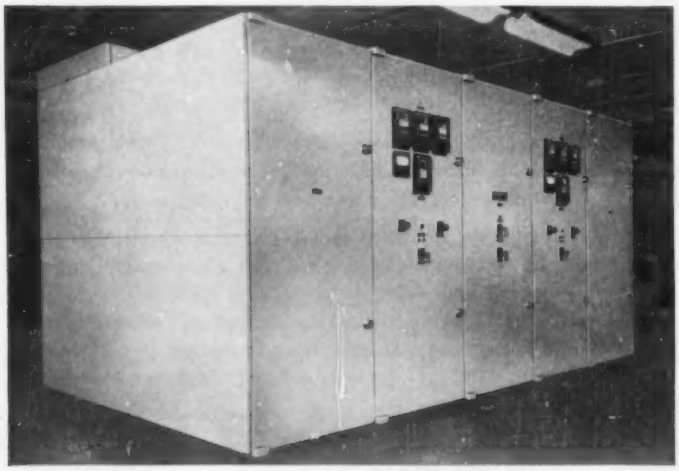
The 'Jeep'®

family of 4-wheel drive vehicles

WILLYS... makers of the world's most useful vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

No cranes are required. Arc chutes pivot. Rest on fixed stop. Illustration shows 15 kv magnetic air circuit breaker.



I-T-E Switchgear in 15 kv rating. All I-T-E circuit breakers are horizontal drawout, interchangeable in like ratings.

TILTING ARC CHUTES

New I-T-E development for 15 kv air circuit breakers

The saving of time and effort which the new I-T-E tilting arc chutes make possible can best be appreciated by anybody who has ever removed the other kind. When inspection time comes, there's no crane lifting of heavy assemblies, no danger of dropping and damaging valuable parts. The arc chutes pivot back safely out of the way for easy inspection of contacts and arc plates. Only I-T-E makes magnetic air circuit breakers with this convenient, modern feature.

I-T-E Metal-Clad Switchgear is made in three basic ratings (5 kv, 7.5 kv and 15 kv), and will interrupt through 500,000 kva. Throughout the line, time-proved features add extra value. Circuit breakers are jig fitted to enclosures. Welded, rigid frames and housings can be lifted as a unit without losing alignment. Complete isolation of compartments insures safety and continuity of service.

Take advantage of I-T-E planning and engineering assistance when you order switchgear. It assures you protection with economy, plus better performance. For details, contact the I-T-E field office nearest you—look in your classified directory under "Electric Equipment." Or write for Bulletin 7004C. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY Switchgear Division

I-T-E

In The News

Business' Plans For Capital Spending In 1956

American business now plans to spend 13% more for new plants and equipment in 1956 than in 1955. This is the largest increase in planned capital spending since 1951, when plans were boosted to meet the Korean War emergency.

Present plans call for total business capital expenditures of $33.4 billion in 1956, compared with $29.4 billion in 1955 and $29.2 billion in 1953, the previous peak year.

Manufacturing companies plan to increase capital spending 30% in 1956 —by far the largest increase reported since just after Korea. Expenditures by commercial business, railroads, other transportation and communications companies will also be up substantially, according to present intentions.

The petroleum industry, as a whole, plans a 6% increase in 1956. Expenditures by electric and gas utilities will be down slightly. And spending by mining industries will also be lower.

Survey results indicate that the new boom in capital spending may carry on into 1957. A large proportion of the reporting companies expect to equal or exceed their 1956 expenditures the following year.

Companies in almost every field expect sales to rise in 1956. For manufacturing as a whole, the anticipated increase is 7%. Optimism on sales was more widespread than in any recent survey.

These are the key results of the preliminary survey of Business' Plans for New Plants and Equipment conducted by the McGraw-Hill Department of Economics. Most replies were received during the last three weeks of October, well after the first announcement of President Eisenhower's illness. Plans reported in this survey are preliminary, because many companies do not complete their budget reviews until later in the year. But in the past, these advance estimates have accurately shown the trend of capital spending.

Capital Spending in Manufacturing

In every line of manufacturing, companies are planning higher expenditures next year. The largest increases are in primary metals, in the chemical industry, and in the automobile industry.

Expansion is starting again in the same lines that added so much capacity during the Korean War boom. The steel and non-ferrous industries particularly added what was then thought to be a large amount of reserve capacity. And their expenditures for the past two years have been at reduced levels. But now these companies are planning new and large increases in spending—72% for steel and 54% for the non-ferrous group.

The chemical and petroleum refining industries, which also built considerable defense-supporting capacity in 1951-53, then slackened in 1954-55, now plan to boost expenditures sharply in 1956. Planned increases are 34% in chemicals and 13% for oil refineries. Paper and rubber companies are also scheduling much higher outlays. In all these lines, companies report that capacity is tight. The expansion of civilian demand has been greater than the old defense requirements. And further large sales increases are expected in the near future.

In metalworking, the picture is dominated by the tremendous program of the automobile industry. The major automobile companies plan substantial expansion of facilities next year, as well as new equipment to produce restyled cars for 1957 and continuing automation of production. The planned increase of 68% will bring spending to $1.9 billion. This is the largest total for any single manufacturing industry, and exceeds autos' previous record expenditure of $1.3 billion in 1954. These figures do not include special tools, dies, jigs and fixtures. Spending in the other major metalworking lines—machinery and electrical machinery—will be up, but plans are not yet equal to the peak expenditures made in 1953.

The food and textile industries are planning moderately higher capital expenditures next year. In food processing, this continues a long-term growth trend. But in textiles, it is an upturn after several years of curtailed capital spending.

Non-Manufacturing Industries

The petroleum industry expects to increase its total spending 6% in 1956. Expenditures for new oil well drilling and other production equipment will be up 6%, according to this survey. Expenditures for the refining sector will be up 13%, and marketing 7%. However, new pipeline construction is scheduled to decline in 1956, resulting in lower expenditures for the transportation division of the industry.

The mining industries are cutting spending by 15% next year. The drop is mainly in non-ferrous mining. Coal

A SECOND LOAN of $200,000 was made under the Silver Jubilee Plan from the Vacation Expense Fund of the Joint Industry Board of the Electrical Industry, New York City. The check was presented to Mr. Keenan during the recent NECA Convention in New York City. Shown from left to right—Jeremiah P. Sullivan, president, IBEW Local No. 3; J. D. Keenan, International secretary, IBEW; J. W. Frommer, a trustee of the Pension Fund; Gordon M. Freeman, International president, IBEW; Harold A. Webster, chairman, Joint Industry Board of the Electrical Industry and chairman of the Vacation Expense Fund; A. Lincoln Bush, chairman of the Pension Fund; Harry Van Arsdale, business manager, IBEW Local No. 3; Denis J. Crimmins, executive secretary-treasurer, Joint Industry Board of the Electrical Industry.

QUAD LIGHTING

INDOOR . . . QUADRANGLE . . . OUTDOOR

FINEST QUALITY ILLUMINATION
for year 'round profitable sales

★ Easy Tach RLM STANDARD DOME

A brand new addition to the QUAD line of industrial reflectors is the Easy Tach—the latest development in quick connecting and disconnecting sockets. The illustration shows it applied to the widely used Standard Dome which is also available in several types of reflector socket construction.

★ SAFETY HOOD RLM GLASSTEEL DIFFUSER

An all white unit with opal glass globe and perforated reflector to provide maximum diffusion with upward light component. Safe and easy to maintain—free from objectionable brightness, glare, or shadow.

★ RLM SYMMETRICAL ANGLE

This style reflector is being sold particularly where side mounting industrial illumination is required. With weatherproof sockets, it is also suitable for outdoor use. Illuminates a wide area and affords desired eye shielding.

★ RLM DEEP BOWL

Sold where localized lighting is required such as for machine tools, over work benches, and along production lines—also where high intensity illumination is needed over a small working area.

★ Easy Tach RLM HIGH MOUNTING REFLECTOR

Adapted for use in industrial plants to provide uniform illumination where mounting heights equal or exceed the spacing distance. This type reflector is entirely weatherproof so that it can be sold for outdoor applications as well as indoor. This unit is also being used for gymnasium lighting. Also available in standard socket reflector construction as well as with Easy Tach.

See the complete line in our reflector catalog No. 10.

QUADRANGLE MFG. CO.
32 S. PEORIA ST. CHICAGO 7, ILL.

EARLY ARRIVALS awaiting opening of "code workshop" at Western Section, IAEI convention in Minneapolis are C. G. Teich, chief electrical inspector, Ames, Iowa; and Joe Loffredo (right) electrical contractor from Des Moines.

and iron mining expenditures will be about the same.

These figures do not include expenditures by the iron mining companies for new plants to treat taconite and other low-grade ores. Complete figures on such plants are still not available. But on the basis of figures reported by companies in this survey, it appears that expenditures for treatment plants may run as high as $200 million per year, as an average for 1955 and 1956.

Railroads plan to boost capital spending 27% in 1956, reflecting the high level of rail traffic and improved earnings of the railroad companies. Other transportation and communication industries—airlines, shipping, trucking, telephones—also plan to raise spending, by 16% for the group as a whole.

Electric and gas utilities together are scheduled to spend 10% less in 1956. This is primarily due to a drop in spending on gas pipelines. Electric power companies will spend less on generating equipment, but more on transmission and distribution equipment.

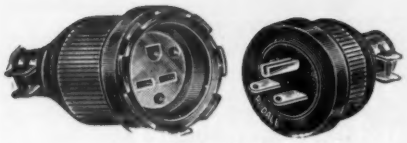
CABLE FASTENING methods were the topic of conversation for (l. to r.) Inman Cooke, Cooke & Associates, Clearwater, Fla., and C. W. "Bill" Payne and A. C. Lenhart, both of Lenhart-Payne Electric, Leesburg, Fla., during recent annual convention of Florida Association of Electrical Contractors in Jacksonville.

NOW! THE MOST COMPLETE LINE

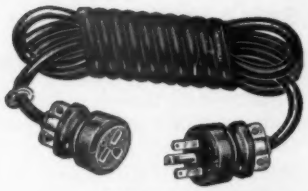
TANDEM BLADE

15 AMP—250 VOLTS

3-WIRE GROUNDING DEVICES

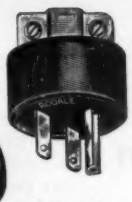


CAT. NO. 1909N
CAT. NO. 1909

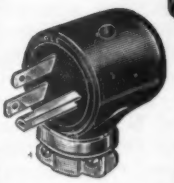


CAT. NO. 696

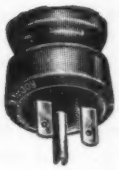
NO. 676



NO. 679



NO. 689



NO. 683

NO. 684

NO. 670
NO. 670V

NO. 672
NO. 672V

NO. 674

For installations where grounding is required in accordance with the New National Electrical Code, RODALE offers this complete line of 3-wire grounding type devices. Incorporating top-quality materials and rugged construction these new heavy duty industrial devices are designed for dependability and trouble-free performance. Available in a variety of materials and styles, there is a RODALE receptacle, cap or cord connector for every grounding device application. RODALE also manufactures a complete line of 125 volt parallel blade grounding devices. Detailed information on both of these popular lines is available on request.

Sold only through Electrical Wholesalers.

NO. 685

NO. 686

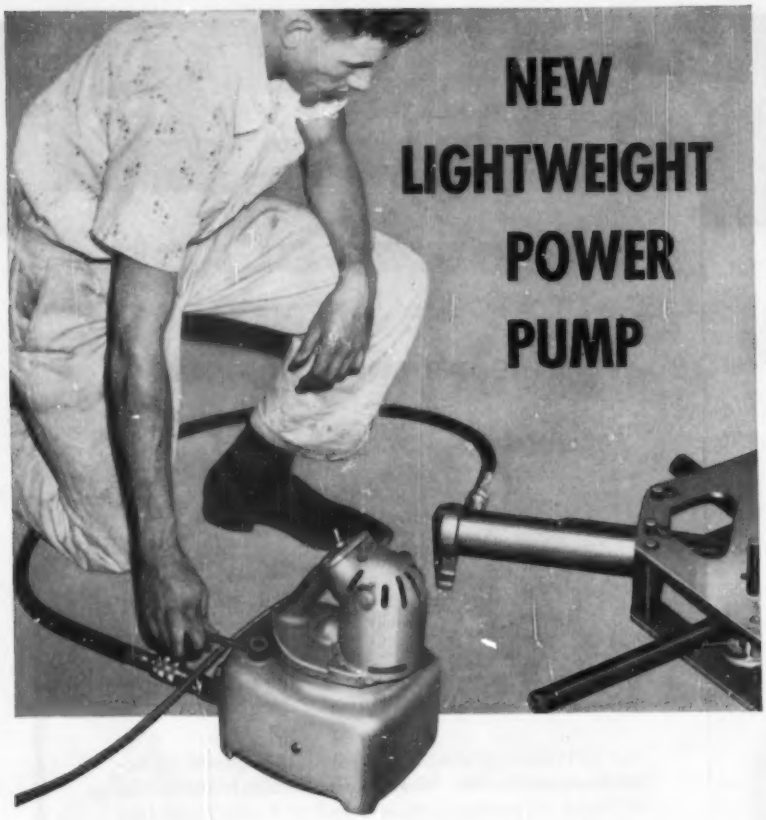
NO. 675

NO. 699

NO. 677

Rodale

MANUFACTURING COMPANY, INC.
EMMAUS, PENNSYLVANIA



for easy, fast operation of your hydraulic pipe benders and hydraulic rams of all types

Put this powerful, portable power pump to work on your hydraulic tools and see how much easier and faster your jobs go.

This new, *lightweight* GREENLEE 798-CO pump can be used not only on GREENLEE hydraulic pipe benders and pushers, but on hydraulic rams of all descriptions.

Weighing only 50 pounds . . . some 40 pounds less than previous types . . . this new GREENLEE power pump with aluminum alloy motor closure and pump housing is easily carried from job to job.

Other advanced features include quick approach, adjustable-pressure valves, and a powerful ½-hp universal motor that operates on 110 a-c or 115 d-c current. Thus, this pump may be used in any plant or on any job without questioning the type of current available.

Get the complete story today, write for details on the new GREENLEE 798-CO portable power pump that saves work, speeds jobs, and brings extra profit to your operation.

TOOLS FOR CRAFTSMEN
GREENLEE

GREENLEE TOOL CO., 1752 COLUMBIA AVE., ROCKFORD, ILL., U.S.A.

COMMITTEE CHORES occupy post-session time of electrical inspectors (L to R) Walter Roach, Louisville, Ky., G. C. Monroe, Springfield, Mo., and D. P. Robinson, Lansing, Mich., at recent Western Section IAEI convention in Minneapolis.

Sales to Double in 10 Years, NEMA Hears

James W. Corey, president, The Reliance Electric and Engineering Co., Cleveland, Ohio, was elected president of the National Electrical Manufacturers Assn. at the 29th annual convention held in Atlantic City last month. Mr. Corey succeeds A. F. Metz, chairman of the board, The Okonite Co., Passaic, N. J.

More than 600 leading electrical manufacturers attended the five-day convention. In addition to the new president the NEMA board of governors re-elected A. A. Berard, president, Ward Leonard Electric Co., Mt. Vernon, N. Y., as treasurer for the ensuing year, and named five vice presidents, two members of the officers at-large and three appointees to the board.

Participating in the convention's business symposium were: Don G. Mitchell, chairman of the board and president, Sylvania Electric Products Inc.; Gwilym A. Price, president, Westinghouse Electric Corp.; Hoyt P. Steele, president, Benjamin Electric Mfg. Co.; and Robert S. Stevenson, president, Allis-Chalmers Mfg. Co.

The Hon. Carlos P. Romulo, Philippine Ambassador to the United States and delegate to the United Nations, spoke at a special events luncheon. He discussed the future role to be played by Asian countries in international problems.

The production of electric products will reach $35 to $40 billion annually within 10 years—more than double the current annual rate, according to Don G. Mitchell. He warned, however, that a greatly increased rate of mechanization will be necessary in order to meet these requirements.

"To meet our opportunities, we must depend upon broader and broader uses of the machine to give our work-

Levolier®

No. 4300-PB Phenolic Lampholder

new design

Rugged Too! Defies Replacement

What you don't see in this modernly-styled Levolier® industrial lampholder is as important as its attractive lines. Built to eliminate replacement, the lampholder cap and casing is double thick impact-resisting molded phenolic. The screw shell inside is .006" heavier than standard. The housing, which screws together at the lever, encloses the proven Levolier® switch mechanism with either push button action or universal lever control. Models include ⅛", ⅜", ¼" and pendant caps.

install it — forget it

Levolier®

SWITCH No. 41

unconditionally guaranteed

IT'LL LAST A LIFETIME

You have no replacement worries when you use the No. 41 Levolier® switch. It has no match for quality and is so trouble-free and durable it is unconditionally guaranteed against failure. Ideal in any canopy mounting for individual control of fluorescent or incandescent lighting — also FHP motors. Its rugged, one-piece molded phenolic case gives better insulation and makes wiring easier. 6 amp, "T" rated, 125 volts. Underwriters' Laboratories approved.

only McGILL makes Levolier® Switches

130-CA

157-C

THE SAFE WAY

to change lamp bulbs is with McGILL® adaptable lamp changers

You keep your feet on the ground even when you're changing lamp bulbs up to 30 feet above the floor with the McGill Adaptable Lamp Changer. Lightweight steel pole is furnished in 5' insulated sections that lock together securely by spring-actuated buttons. Several style heads available for virtually any size, shape and type of bulb.

McGILL® grounded guards with the PREFERRED NEW GROUNDING ARRANGEMENT

No. 5023-SRG

★ Conform to N. E. C.

★ Grounding adopted as standard by American Standard Ass'n.

★ Underwriters' Laboratories Inspected

McGill grounded portable lamp guards give you the advantages of the preferred, new grounding arrangement—a 3-blade plug and convenience outlet with 2 parallel blades and a U-shaped third blade for ground. These portables will outlast several "inexpensive" portables because all component parts are quality built — molded phenolic handles — heavy steel wire cages, electrically welded and zinc plated with bright chromate finish. Levolier switch and keyless types, with or without 16-3 SJ black rubber cord.

50th McGILL Anniversary

YOU CAN DEPEND ON

McGILL QUALITY

Available through leading Electrical Wholesalers

For complete information on products of the McGill Electrical Division, write today for Catalog No. 49-A.

McGILL MANUFACTURING COMPANY, INC.
450 N. Campbell St., Valparaiso, Indiana

C-o-o-l OPERATION *through* **SCREEN VENTING**

Yes, cooler, safer and more trouble-free operation—longer and better protection—with Pierce Fuses! Their venting permits free flow of air through the interior—keeps fuses 10 to 40% cooler—prevents afterblow by permitting dangerous gases and pressures to vent if a link lets go to protect equipment.

Pierce quality is recognized. Their tubular bridge, for instance, assures continually correct knife blade alignment and perfect clip contact. Cases last 6 to 8 times longer. All Pierce quality Fuses are equipped with the famous Balanced Lag Links. Yes, Pierce offers you fuse protection that is unequaled.

It Pays YOU

It Pays YOUR CUSTOMERS

TO STANDARDIZE ON

PIERCE QUALITY FUSES

(Also a complete line of quality non-renewable fuses.)

WRITE TODAY for this helpful booklet on fuses that positively avoid afterblow.

PIERCE RENEWABLE FUSES, INC.
LEICESTER NEW YORK

YOUNG ENGINEERS with Miller Electric Co., Jacksonville, Fla., presently assigned to electrical construction work on the Atomic Energy Commission's Savannah River Project, and attending the recent annual convention of the Florida Association of Electrical Contractors in Jacksonville were (l. to r.) C. W. Hollerung, Legrand Richardson and J. T. Hill.

ing force the increased skill and productivity which the future will demand," he declared. "If we do not do so, we will be faced with a serious labor shortage . . ."

Because of the growth in the use of electric products, the consumption of electric power will reach an annual rate of a trillion kilowatt hours by 1956, Mr. Mitchell predicted. He pointed out that this represented a revised estimate of the original prediction of about a year ago that a trillion kilowatt hours would be reached by 1970.

Use of electricity by residential customers will equal that of industry by 1973, said Gwilym Price. He cited three factors: the population growth, more new homes and more money available to the average consumer.

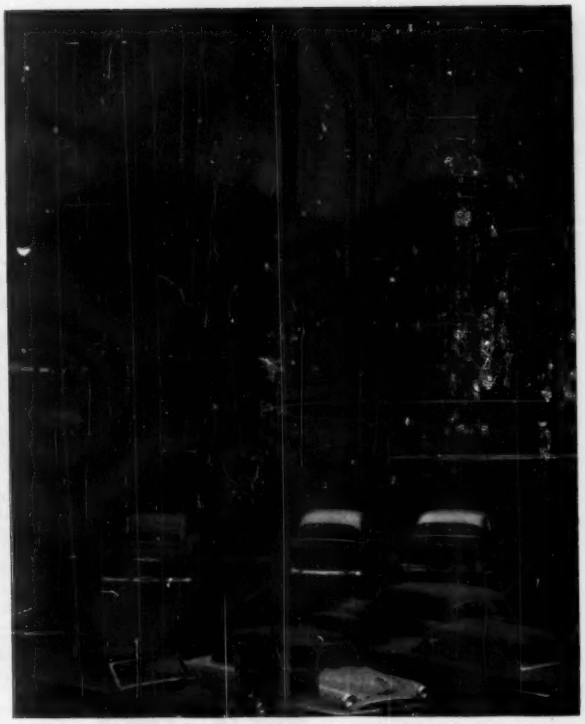
All, however, Mr. Price cautioned, will not be clear sailing. He enumerated as the need to "sell as we have never sold before"; the necessity of breaking the bottleneck of inadequate wiring; and the development of atomic power to provide the electricity to take care of rising electrical demands.

Hoyt P. Steele told his NEMA listeners that labor unions, to a very increasing extent, in the future, will devote more and more of their energies to political, economic and social objectives as opposed to the classic job of representing members in collective bargaining for wages, hours and working conditions.

These trends, he said, have been apparent to a greater or less extent in "every single bargaining session that has been held over the country in the last few years".

Business in the electrical industry will double in the next ten years

LINE VOLTAGE DROPS TO 80V ON SOLA CONSTANT-WATTAGE BALLASTED INSTALLATION: *"Outages" are prevented due to the patented constant wattage circuit in Sola Mercury Vapor Lamp Transformers. Even when line voltage drops as low as about 75v on a 115v line, lamps stay lit, eliminating the need for "auxiliary" incandescent or fluorescent lighting installations.*



LINE VOLTAGE DROPS TO 80V ON CONVENTIONALLY-BALLASTED INSTALLATION: *Line voltage drops often cause outages. Until lamps return to strikeable condition, vital minutes of production time may be lost in industrial installations; safety hazards may exist in parking lots (as shown above) or playgrounds or plant area protection applications.*

Sola Constant Wattage Transformers For E-H1 400w Mercury Vapor Lamps End Outages Due to Line Voltage Drops

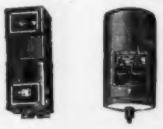
When your mercury vapor lighting installation is ballasted with Sola Mercury Vapor Lamp Transformers, you can rely on dependably-maintained light output. First, outages are virtually eliminated since primary voltage must drop below about 75v on a 115v line before lamps extinguish. Second, the Sola Patented Constant Wattage Principle assures lumen regulation within $\pm 2\frac{1}{2}\%$, even in the face of line voltage variations as great as $\pm 13\%$.

In addition, Sola Constant Wattage Mercury Vapor Lamp Transformers offer the following advantages over conventional ballasts:

- Eliminate the need for primary taps . . . positive starting within the primary ranges of 100 to 130 and 200 to 260 volts.
- Low starting current surge . . . line current during starting interval limited to effectively no more than normal full load value.
- Open and short-circuit protection . . . primary current positively limited under abnormal operating conditions of lamp failure, or external short circuit . . . constant wattage circuit eliminates any lamp electrode rectification.
- Extended lamp life . . . regulated voltage, current, and wattage permit continuous, stable operation, resulting in superior lamp life.
- Low crest factor . . . (peak/rms ratio) of lamp current averages only 1.7 at 115v primary supply.

It will pay you to investigate the advantages of Sola-ballasted mercury vapor lighting installations for both indoor and outdoor high intensity lighting applications. Request your Sola representative to call.

SOLA *Mercury Vapor Lamp* **TRANSFORMERS**



Write on your letterhead for Bulletin 17L-MV-219

CONSTANT VOLTAGE TRANSFORMERS for Regulation of Electronic and Electrical Equipment • **LIGHTING TRANSFORMERS** for All Types of Fluorescent and Mercury Vapor Lamps. • **SOLA ELECTRIC CO., 4633 West 16th Street, Chicago 50, Illinois, Bishop 2-1414** • *NEW YORK 35: 103 E. 125th St., TRafalgar 6-6464* • *PHILADELPHIA: Commercial Trust Bldg., Rittenhouse 6-4988* • *BOSTON: 272 Centre Street, Newton 58, Mass., Bigelow 4-3354* • *CLEVELAND 15: 1836 Euclid Ave., PRospect 1-6400* • *KANSAS CITY 2, MO.: 406 W. 34th St., Jefferson 4382* • *LOS ANGELES 23: 3138 E. Olympic Blvd., ANgelus 9-9431* • *TORONTO 9, ONTARIO: 617 Runnymede Rd., RO 7-1654* • *Representatives in Other Principal Cities*

fast way to figure cable terminating needs

UNIT PACKAGE TERMINATING KITS FROM

PLM

UNIT PACKAGE TERMINATING KITS FOR:

ARMORED CABLE

•

RUBBER INSULATED CABLE

•

LEAD COVERED CABLE THROUGH 23 KV

● Be sure of the right materials, in the right amounts, in the right places, for every termination to be made in cable runs! PLM Unit Package Terminating Kits simplify planning...eliminate endless details in specifying, ordering and stocking. Each Kit contains detailed instructions and correct materials for terminating one cable of specified rating and type.

ONE order from PLM can take care of ALL your terminating or splicing needs. Ask for catalog or quotations.

PLM *Products, Inc.*

3875 West 150th St. • Cleveland 11, Ohio

WIRE AND CABLE FITTINGS AND ACCESSORIES

Armored Cable Terminators • Splicing and Terminating Kits • Conduit Ventilators

LET OUR ENGINEERS SOLVE YOUR TRANSFORMER PROBLEMS

Standard Transformer engineers work with your engineers to solve transformer problems at no cost to you. Send us your plans and let us work out a practical, efficient, and economical solution. Write Standard today. There's no obligation.

Type "A" Distribution Transformer, 75 KVA, 2400/4160Y to 120/240 volts, single-phase, 60-cycle. One of a complete line of Standard Transformers developed for every class of service.

Standard®

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

CHECKING RISING SALES totals of Minneapolis part of the Twin-City Residential Rewiring Package Plan promotion are: (L to R) contractor John Mester, chairman Minneapolis Electrical Contractors Association business development committee; Walter Amundsen, rewiring specialty salesman; and O. F. Norgren, manager Upper Midwest Chapter, NECA. Amundsen, a former journeyman electrician and contractor, combines technical experience with sales ability; estimates and quotes the rewiring jobs. Contractors accept his figures.

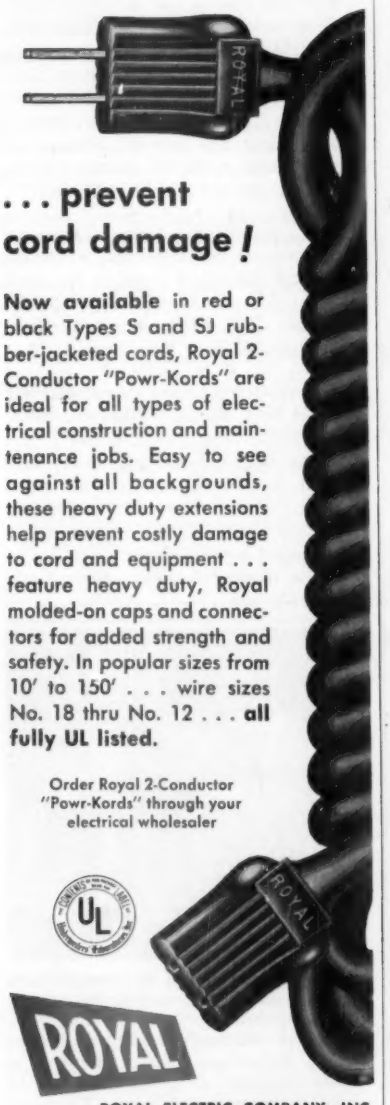
bringing with it an increase in the consumption of all types of products and a need for greater productivity per worker. This optimistic view was presented by Robert S. Stevenson, who estimated that a total of $21 billion would be invested over the next decade by power suppliers for generating and heavy transmission equipment to supply and deliver all of the needed future electric energy.

Wiring bottlenecks to the increased use and sale of electricity and electrical equipment will receive an added jolt next year with the initiation of a program to accomplish in the commercial and institutional field what is being done in the residential and farm areas.

The commercial and institutional wiring program, like the residential wiring activity, will be coordinated by the National Adequate Wiring Bureau. The farm wiring program will continue under the Farm Wiring Subcommittee of the NEMA Farm and Rural Market Development Committee. As a starter for 1956, the new activity will undertake a market study to select from the many different types of commercial and institutional structures those in the greatest need of immediate attention. The Codes and Standards Committee is studying the fundamental engineering and safety considerations of the application of higher voltages to feeders, circuits, and utilization equipment for all types of occupancies. A subcommittee is also studying the development of many new insulating materials and manufacturing processes, and their relations to existing standards.

J. J. Mellon, NEMA Chairman on

ROYAL 2 Conductor
POWR-KORD EXTENSIONS



. . . prevent cord damage!

Now available in red or black Types S and SJ rubber-jacketed cords, Royal 2-Conductor "Powr-Kords" are ideal for all types of electrical construction and maintenance jobs. Easy to see against all backgrounds, these heavy duty extensions help prevent costly damage to cord and equipment . . . feature heavy duty, Royal molded-on caps and connectors for added strength and safety. In popular sizes from 10′ to 150′ . . . wire sizes No. 18 thru No. 12 . . . **all fully UL listed.**

Order Royal 2-Conductor "Powr-Kords" through your electrical wholesaler

ROYAL

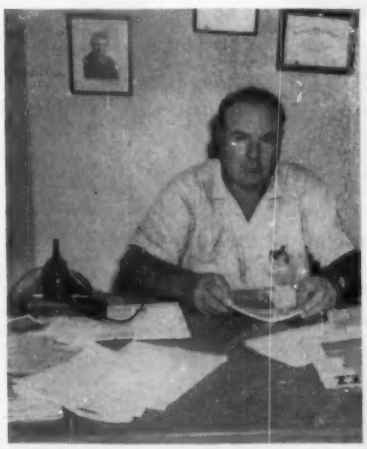
ROYAL ELECTRIC COMPANY, INC.
PAWTUCKET • RHODE ISLAND

Safety Regulations, reported that regulatory authorities, at the municipal, state and federal levels, were feeling it necessary to establish new controls and regulations to answer the new problems confronting them.

"Air conditioning, relighting programs, modernization programs, decentralization of industry, extension of spot distribution networks . . . contribute to bring the electrical inspector face-to-face with problems with which he is not familiar."

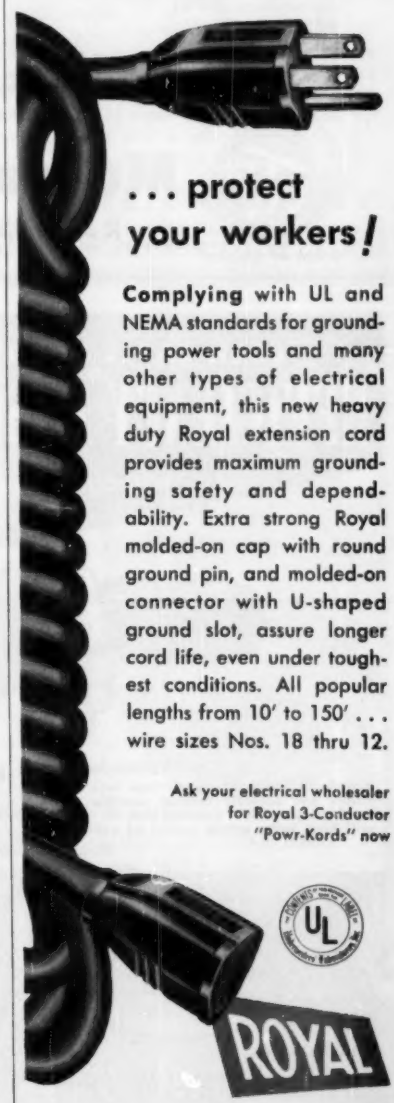
Consequently, the report stated, the old cry, "there ought to be a law" was constantly being raised, with the result that many regulations are forming barriers to free and open markets for products. The lack of uniformity in municipal codes and ordinances was cited as probably the most outstanding problem. Progress on uniformity of application of the National Electrical Code was slow, but noticeable.

J. L. Singleton, vice president, industries group, Allis-Chalmers Mfg. Co., was named a new vice president of the association. The following were re-elected vice presidents: William S. Edsall, president, Chase-Shawmut Co.; S. M. Ford, president, Silex Co.; Harvey Hubbell, president, Harvey Hubbell, Inc.; J. H. Jewell, vice president, Westinghouse Electric Corp.; J. R. MacDonald, president, General Cable Corp.; B. C. Neece, president, Landers, Frary and Clark; W. V. O'Brien, vice president and general manager, Apparatus Sales Div., General Electric Co.; F. H. Roby, vice president, Square D Co.; and Hoyt P. Steele, president, Benjamin Electric Mfg. Co.



MODERNIZATION work is growing in volume for W. L. Dotson, Sr., Dotson Electric Co., Savannah, Ga., who already has enough electrical work on new construction projects to keep him and his son, W. L. Jr., a former University of Maryland football star, plenty busy.

ROYAL 3 Conductor
POWR-KORD EXTENSIONS



. . . protect your workers!

Complying with UL and NEMA standards for grounding power tools and many other types of electrical equipment, this new heavy duty Royal extension cord provides maximum grounding safety and dependability. Extra strong Royal molded-on cap with round ground pin, and molded-on connector with U-shaped ground slot, assure longer cord life, even under toughest conditions. All popular lengths from 10′ to 150′ . . . wire sizes Nos. 18 thru 12.

Ask your electrical wholesaler for Royal 3-Conductor "Powr-Kords" now

ROYAL

WIRE • CORD SETS • FUSES • WIRING DEVICES

FOR *Quality* WITHOUT *Question*

450 KVA, three phase, dry type transformer. Primary 480 Secondary 208Y/120, 4—2 1/2% FCBN

The Beverly Hilton uses only the finest, from champagne to transformers.

The fabulous Beverly Hilton has installed Marcus Transformers with a total capacity of approximately 2000 KVA. This guarantees them complete dependability and uninterrupted, trouble-free service for their power and lighting distribution.

A complete line of dry and liquid-filled transformers up to 5000 KVA.

Representatives in Principal Cities

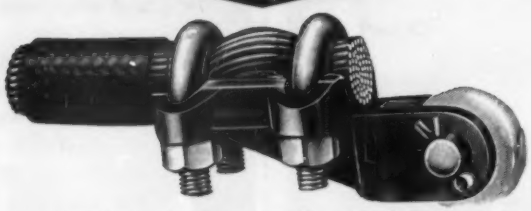
"Mark of Quality"

Marcus TRANSFORMER CO., Inc.
RAHWAY, NEW JERSEY

LOCK CABLE SAFELY, SECURELY *with*—

"EFFICIENCY" Cable Strain Clamps

without Strain or Damage



. . . withstands direct pull at 17,000 pounds

Efficiency Cable Strain Clamps lock cable safely and securely without possibly strain or damage. "H" construction of clamps and high ridge across center of cable prevents cable from slipping. Takes cable from 1/0 to 1,500,000 c. m. Three clamp sizes cover all cable sizes. Furnished with eye or clevis, for AC or DC service.

Write for Catalog 38-A

Efficiency ELECTRIC AND MANUFACTURING CO.

MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT, WIRE AND CABLE SUSPENSION

EAST PALESTINE, OHIO

"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

NISA News

Ray Wilson, staff engineer for NISA, made over 85 calls to various shops in several parts of the country during the last 12 months.

• • • •

New England Chapter's regular meeting was held September 15 at Hotel Bradford, Boston. Frank Maria delivered a talk on the topic "Human Relations".

• • • •

Charles H. Norris, Bay Electric Works, was elected president of the San Diego chapter; T. F. Clute, a vice president and Frank W. Sloan, secretary-treasurer.

• • • •

NISA president Joseph H. Previty made his first official visit to the Southwestern meeting in San Angelo, Texas, September 8-10.

• • • •

Southeastern Chapter Conference was held in Staunton, Va., on October 6. George Treiber spoke on "The Triangle of Fire". Joe Previty presented "Rewinding Hermetically Sealed Motors". Roy E. Shinault of Roy's Electric Motor Service, Richmond, moderated a technical forum.

• • • •

The following visited National Headquarters recently: Jim Anderson of A & P Electrical Repairs, St. Paul, Minn., Joseph H. Previty, NISA president, B. L. Sommer and W. Nicot of Foremost Elec. Co., Peoria, Ill.

• • • •

Midwestern Chapter's next meeting will be held in Marshalltown, Iowa, April 1956. The group, at its recent meeting in Fort Dodge, Iowa, also agreed to sponsor a chapter award contest. Nick Tamasi of Electric Equipment Co., Des Moines, Iowa, was named contest chairman.

From Walter J. Prise, New York, N. Y.

MUTUAL AGREEMENT on interpretation of a NEC rule is the result of this confab between contractor V. H. Stanton (left) and chief electrical inspector Donald Durfey, Columbus, Ohio. Stanton, a former Columbus electrical inspector, is active in promoting National Electrical Week in Ohio.

DATES AHEAD

Industrial Heating Equipment Association, Inc.—Annual meeting, LaSalle Hotel, Chicago, Ill., January 23-24.

Plant Maintenance & Engineering Show and Conference—Convention Hall, Philadelphia, Pa., January 23-26.

National Rural Electric Cooperative Assn.—St. Louis, Mo., January 23-26, 1956.

American Institute of Electrical Engineers—Winter general meeting, Hotel Statler, New York, N. Y., January 30-February 3.

Independent Electrical Contractors Assn., Inc.—Annual dinner and dance, Hotel Biltmore, New York, N. Y., February 11.

Rochester Electrical Exposition—Sponsored by the Electrical Association of Rochester, to be held in War Memorial Building, Rochester, N. Y., February 18-25.

National Adequate Wiring Conference—La Salle Hotel, Chicago, Ill., February 23-24.

National Electric Sign Association—Annual convention and exhibit, Jefferson Hotel, St. Louis, Mo., February 26-29.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 12-16.

Electrical Industry Show—8th Biennial show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

Illuminating Engineering Society—Regional Conferences: **Southern**—Birmingham, Ala., April 5-7; **Southwestern**—Hilton Hotel, Fort Worth, Texas, April 8-10; **South Pacific Coast**—San Francisco, Cal., April 15-17; **Pacific Northwest**—Davenport Hotel, Spokane, Wash., April 19-21; **Inter-Mountain**—Utah Hotel, Salt Lake City, Utah, April 26-28; **Great Lakes**—Toledo, Ohio, May 7-8; **Midwestern**—Indianapolis, Ind., May 10-11; **Canadian**—Chateau Frontenac, Quebec, P. Q., Canada, May 17-18; and **East Central**—Shoreham Hotel, Washington, D. C., May 24-25.

National Industrial Service Association, Inc.—Annual convention Bellevue Stratford Hotel, Philadelphia, Pa., May 13-17.

Edison Electric Institute—24th Annual Convention, Atlantic City, N. J., June 4-7.

National Fire Protection Association—60th Anniversary meeting, Hotel Statler, Boston, Mass., June 4-8.

National Association of Electrical Distributors—48th annual convention, Ambassador-Chelsea Hotels, Atlantic City, N. J., Week of June 10.

New York State Association of Electrical Contractors and Dealers, Inc.—Annual convention, Saranac Inn, Saranac Inn, N. Y., June 24-29.

Illuminating Engineering Society—National Technical Conference, Hotel Statler, Boston, Mass., September 17-21.

SIMPLET

VAP-OIL-TITE CONNECTORS

For Liquid-Tight Flexible Metallic Conduit

The Original and Dependable Split Ring Connector

PREVENTS COSTLY SHORTS and DOWNTIME

The time-proven Simplet Vap-Oil-Tite principle, using a split ring and threaded grounding bushing, insures a permanently safe connection, positively sealed against vapor, oil, water or dust. Compression nut squeezes the grooved split ring, makes it grip the conduit with tremendous pressure, while multiple points of contact between the ring and inside of the connector body provide a perfect seal. Corrosion resistant zinc or aluminum. Write for new bulletin and prices.

SIMPLET **SIMPLET ELECTRIC COMPANY**
WHOLLY OWNED SUBSIDIARY OF IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

BARTH CABLE PULLER
does the toughest tape pushing job IN MINUTES!

Distributed Nationally by:
GENERAL ELECTRIC SUPPLY CO.
GRAYBAR ELECTRIC CO.
WESTINGHOUSE ELECTRIC SUPPLY CO.
and other leading distributors

PUSHES TAPE... PULLS WIRE ...ELECTRICALLY! Now... one man can push tape through 175 feet of conduit, around five 90 degree bends and pull wire back ... all in a fraction of the time formerly used. Ideal for difficult runs impossible to push by hand.

THE BARTH electric powered CABLE PULLER attaches directly to conduit ... no strain on junction boxes. Light weight, only 70 pounds. Operates on 115 volts AC or DC. Rugged, quick to set up, easy to move from job to job.

MAIL THIS COUPON TODAY for complete specifications and prices

THE BARTH CORPORATION
12664 Brookpark Road, Cleveland 30, Ohio

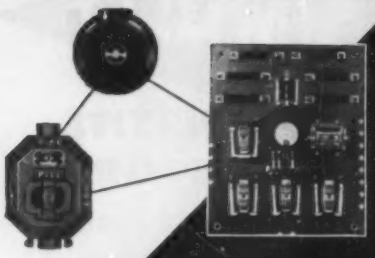
Please send complete Cable Puller data folder and prices.

NAME _____ YOUR COMPANY _____

ADDRESS _____

CITY _____ ZONE ___ STATE _____

Interior Fire Alarm Systems



coded and non-code types

Complete reliability is the one thing we demand from a fire alarm system. Therefore, when ordering Interior Fire Alarm Systems, be sure to specify equipment (control panels, stations, and fire alarm bells) produced by Signal Engineering & Manufacturing Co., the originators of A-C Fire Alarm Systems.

Both coded and non-code types are available in various arrangements depending on type of building or establishment. Although Interior Fire Alarm Systems are intended primarily for warning occupants of a building, they can be connected into a municipal system.

Engineering representatives in principal cities are available to assist in specifications.

Write for Bulletin FA-3

Wheelock FIRE ALARM SIGNAL
ENGINEERING & MFG. CO.
UNION BRANCH NEW JERSEY

It doesn't Cost It PAYS to use HELWIG CARBON BRUSHES

SPEED INSTALLATION
INCREASE BRUSH LIFE
CUT MOTOR DOWN TIME
SLASH MOTOR MAINTENANCE

Motors and generators are a costly investment . . . they deserve HELWIG CARBON BRUSHES. HELWIG CARBON BRUSHES cut down vibration and give better contact — eliminate uneven wear and reduce circulating current.

Brushes are manufactured to size—need not be cut down to fit commutator. It PAYS to protect your electrical equipment with HELWIG CARBON BRUSHES.

HELWIG CARBON PRODUCTS — HELWIG SPEER

2546 N. 30th St.
Milwaukee 10, Wisconsin

McGraw-Hill Mailing Lists Will Help You

- Merchandise your advertising
- Conduct surveys
- Get inquiries and leads for your salesmen
- Pin-point geographical or functional groups
- Sell direct
- Build up weak territories
- Aid dealer relations

Direct Mail is a necessary supplement to a well rounded Business Paper advertising program.

Most progressive companies allocate a portion of their ad budgets to this second medium at the same time as they concentrate on the *best* business publications.

600,000 of the top buying influences in the fields covered by the McGraw-Hill publications make up our 130 mailing lists. Pick YOUR prospects out of our Industrial Direct Mail catalogue.

Write for your free copy of our Industrial Direct Mail catalogue. With complete information.

JACK C. SAULS, Oklahoma Electrical Supply Co., Oklahoma City, is one of the reliable hands supervising widespread operations of this large electrical contracting organization.

Among the Manufacturers

Headquarters Announcements

Wilcolator Co., Elizabeth, N. J.—Patrick E. McCaughey, general sales manager.

Square D Co., Detroit, Mich., and Electric Controller and Mfg. Co., Cleveland, Ohio, have announced that the two firms will merge.

Cory Corporation, Chicago, Ill., has purchased the Mitchell Mfg. Co. of the same city. Mitchell will continue its operations as an independent division of Cory Corp.

Westinghouse Electric Corp., Pittsburgh, Pa.—Bruce D. Henderson, operating vice president and manager of the air conditioning division; J. A. Gilbreath, manager of the packaged products department of the division, supervising production and marketing.

Eastern Insulated Wire Corp., Wallingford, Conn.—J. B. Irwin, sales manager.

General Cable Corp., New York, N. Y.—William M. Powell, general sales manager; Daniel M. Fuge, general merchandise manager; Charles M. Sherwood, assistant general sales manager.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—W. G. Lewis, manager of circuit breaker sales; D. W. Webb, manager of sales, switchgear assemblies and unit substations; E. F. Greiwe, manager of product sales for the electrical section at the Norwood Works.

Lightolier, Inc., Jersey City, N. J.—H. M. Schatz and W. F. Blitzer vice presidents.

Electric Products Co., Cleveland, Ohio—Harvey B. Wilgus, general sales manager.

Electric Storage Battery Co., Philadelphia, Pa.—Evans Taylor, manager-sales engineering of Exide Industrial Division.

Duro Fittings Co., Los Angeles, Calif.—Richard Keefe, sales manager.

Toledo Pipe Threading Machine Co., Toledo, Ohio, has acquired the Port-A-Pony portable power drive. The unit will be manufactured by Thread-Ezy Co., a subsidiary, and distributed by the parent firm.

Precision Transformer Corp., Chicago, Ill., has purchased the engineering and design file covering transformers up to 3000 kva from the Stockwell Transformer Corp., formerly of Akron, Ohio.

Gibson Electric Co., Pittsburgh, Pa.—Malcolm Anderson, sales manager.

Crouse-Hinds Co., Syracuse, N. Y.—Albert H. Clarke, vice president in charge of engineering.

Sterling Electric Motors, Inc., Los Angeles, Calif.—A. J. Allcock, Jr., chief staff engineer.

A-P Controls Corp., Milwaukee, Wis.—James Tate, assistant to the president; Duncan Henderson, administrative assistant in charge of sales.

Multi-Matic Corp., Van Nuys, Calif., has changed its name to Gen-A-Matic Corp.

National Electric Products Corp., Pittsburgh, Pa.—Charles F. Meyer, assistant vice president.

Square D Co., Detroit, Mich.—Grant McDonald, manufacturing manager; Anthony Kasper, controller.

Moloney Electric Co., St. Louis, Mo.—C. M. Lovell, vice president in charge of engineering and research; D. F. Winter, vice president, chief engineer and director of research.

Western Insulated Wire Co., Los Angeles, Calif.—E. B. Kanner, sales manager; Murray H. Owen, director of customer relations.

Regional Appointments

NEW ENGLAND

Permacel Tape Corp: Charles F. Euler, Boston district manager, covering all of New England and parts of New York and Pennsylvania.

Novelty Lighting Corp.: Fred Vorlander, sales representative for New England with offices in Boston.

MIDDLE ATLANTIC

General Electric Co., Construction Materials Div.: William J. Donlin, district representative for Allentown, Pa.

National Electric Products Corp.: Wylie D. McGaffie, Buffalo, N. Y., district sales manager.

PUT LIGHT WHERE YOU NEED IT WITH ABOLITE BIN LIGHTS

This new reflector has been developed to meet the need for better lighting in aisles, corridors, tool rooms, warehouses, libraries, vertical storage racks and bins, and similar hard-to-light locations.

Unique designing forces light to the highest point as well as the lowest, and at the same time the ABOLITE Bin Light reflector provides effective shielding to stop direct side light.

This reflector features the famous ABOLITE All-White high-fired lifetime porcelain enamel finish inside and out. It will not stain or discolor, resists chipping, and is always easy to clean. In any installation ABOLITE All-White reflectors give a clean, neat, modern appearance.

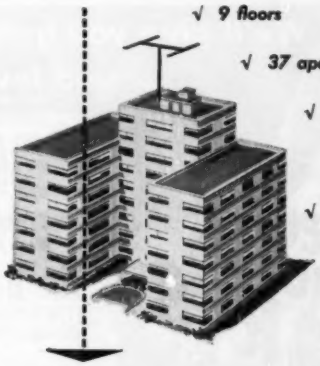
ABOLITE Bin Light Reflectors are furnished for 100-150-200 watt lamps and can be mounted with conduit or direct to outlet box.

Write today for complete information.

WHITER THAN WHITE ABOLITE Lighting

ABOLITE Lighting Division • JONES METAL PRODUCTS CO. • W. Lafayette, Ohio

How would you handle this master antenna problem?



√ 9 floors

√ 37 apartments

√ steel and concrete construction

√ outlying suburban area

RCA MASTER-TENNA*

meets every demand of antenna-system specifications for moderate-size buildings, commercial or residential. Master-Tenna is the system backed by the name you know, by RCA and all its technical resources. Master-Tenna costs less than individual antennas... pays off in tenant fees for building owners... protects their building against rooftop antenna clutter. Master-Tenna means a more popular building... assuring sharp reception in UHF or VHF, black and white or color. Your nearby RCA Service Company branch can give you a boost with Master-Tenna estimates, equipment needs, installation and maintenance. Coupon brings the detailed story.

RCA

*Master-Tenna®

RCA SERVICE COMPANY INC.
A Radio Corporation of America Subsidiary

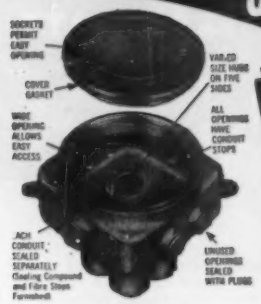
RCA Service Company, Inc. B-4
Master-Tenna Sales
Camden, N. J.
Full details, please, on RCA Master-Tenna.

NAME _____ COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

Revere ELECTRIC MFG. CO. CHICAGO 41

EXPLOSION-PROOF Sealing JUNCTION BOXES

for SAFER Wiring In EXPLOSIVE AREAS!


SOCKETS PERMIT EASY OPENING
COVER GASKET
VARIED SIZE HUBS ON FIVE SIDES
WIDE OPENING ALLOWS EASY ACCESS
ALL OPENINGS HAVE CONDUIT STOPS
EACH CONDUIT SEALED SEPARATELY Sealing Compound and Fibre Stops Furnished
UNUSED OPENINGS SEALED WITH PLUGS

FLUSH TYPE
CAT. No. 4016
PATENT PENDING

Here's just what you've been looking for — JUNCTION BOXES as specified by the National Electric Code for explosive areas that provide protection from explosive vapors creeping to switch boxes or other Electrical Equipment. Both types have varying size hubs on sides and bottom, enabling short, straight runs. Each conduit run sealed separately. Simplified wiring — easy to install — reduced costs.

Get complete facts. Write today.

COVER CONFORMS TO CURB
COVER GASKET
HUBS FOR EASY REMOVAL
WIDE INNER OPENING FOR EASY ACCESS
EACH CONDUIT SEALED SEPARATELY (Sealing Compound and Fibre Stops Furnished)
VARIED SIZE HUBS ON FOUR SIDES
UNUSED OPENINGS SEALED WITH PLUGS
ALL OPENINGS HAVE CONDUIT STOPS

CURB TYPE
CAT. No. 4015
PATENT PENDING

REVERE ELECTRIC MANUFACTURING CO. • 6017 BROADWAY • CHICAGO 40, ILL.
Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto

THE COMPLETE LINE OF FLOODLIGHTS AND POLES FOR SERVICE STATION • SPORTS • AIRPORT • STREET • OUTDOOR THEATRE • MARINE AND INDUSTRIAL LIGHTING

Revere
IS THE ANSWER TO ALL YOUR LIGHTING NEEDS

ENCLOSED FLOODS FROM 150 TO 5000 WATTS

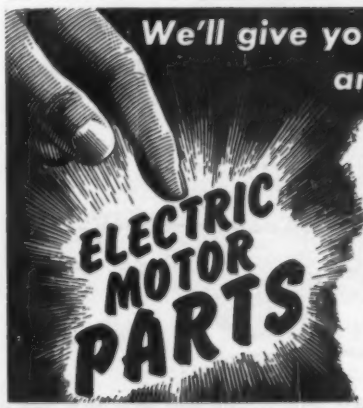
FAMOUS ELIPTOR 300 TO 1500 WATT

ENDOVAL & STAR-LUX MERCURY LUMINAIRES

•

HINGED POLES ORIGINATED BY REVERE

HINGED AND RIGID FLOODLIGHT POLES



on parts for Brown & Brockmeyer • Century • Delco • General Electric • Jack & Heintz • Leland • Marathon • Packard • Redmond • Sunlight • Wagner • Westinghouse—*motors*

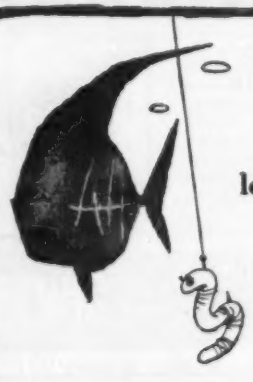
Write for catalog—on your letterhead—to

The HARRY ALTER CO., Inc.

1728 S. Michigan Ave. Chicago, Illinois
134 Lafayette St. New York, N. Y.

WHOLESALE ONLY

HARRY ALTER gives you snappy service!



experience pays

let TWS* prepare your industrial literature

*TECHNICAL WRITING SERVICE
McGraw-Hill Book Co.
330 W. 42nd St., N.Y.C.

send for information

SOUTH ATLANTIC

Western Insulated Wire Co.: Frank Davis, Atlanta, Ga., has resumed activities as sales representative for northern Florida.

Novelty Lighting Corp.: Collin Finney, sales representative for Tennessee with offices in Nashville; Robert Kuzell of Decatur, Ga., will cover Georgia, Alabama and Florida.

EAST CENTRAL

Minneapolis-Honeywell Regulator Co., Industrial Div.: J. W. Hughes, industrial sales manager of the Midwest region, offices in Chicago; Raymond A. Zack, industrial sales manager, Hammond, Ind., branch office.

Duro Fittings Co.: J. L. Weyhing, Louisville, Ky. and S. A. Beaumont, Milwaukee, Wis., manufacturers' representatives.

General Controls Co.: B. L. Lerch, Midwest regional manager; Norbert A. Grainer, manager of Chicago, Ill., branch office.

General Electric Co., Construction Materials Div.: T. S. Hemenway, Jr., Chicago, Ill., district representative for wire and cable products.

WEST CENTRAL

Mitchell Mfg. Co.: Fred A. Doelling, St. Louis, Mo., district manager of the lighting division.

Line Material Co.: E. E. Thompson, apparatus engineer for the North Central division; headquarters in Minneapolis, Minn.

Permacel Tape Corp.: Donald B. Roberts, Missouri Valley division manager; offices in St. Louis.

General Electric Co., Construction Materials Div.: R. W. Eadie, Davenport, Iowa, district representative for conduit products and wiring devices.

Duro Fittings Co.: W. J. Huemmer, Dallas, and E. B. Thorton, Houston, Texas, sales representatives.

Minneapolis-Honeywell Regulator Co., Industrial Div.: P. R. Sharadin, Southwest regional application engineer with headquarters in Dallas.

WEST

Sylvania Electric Products Inc.: C. A. Dickinson, special representative for lighting division accounts having offices in two or more sales districts. Working out of the firm's San Francisco, Calif., offices, he will cover the western states.

Century Electric Co.: B. J. Gill, Northwest district manager, supervising regional sales from a new district office in Spokane, Wash.

Duro Fittings Co.: F. L. Guenther, Seattle, Wash., representative.

General Electric Co., Construction Materials Div.: Wiliam W. Bryan, Pacific District manager; headquarters in Los Angeles, Calif.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

POSITIONS WANTED undisplayed advertising rate is one-half of above rate, payable in advance.

BOX NUMBERS count one line additional in undisplayed ads.

INFORMATION:

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

EQUIPMENT WANTED OR FOR SALE Advertisments acceptable only in Displayed Style.

DISPLAYED—RATE PER INCH:

The advertising rate is $12.90 per inch for all advertising of Equipment & Business Opportunities appearing on other than a contract basis. Contract rates quoted on request. Employment Opportunities—$19.50 per inch subject to agency commission.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E.C.&M.

New ADVERTISEMENTS received at the New York office, 330 W. 42nd St., N. Y. 36, N. Y. by December 21st will appear in the January issue.

LAND

EST. 1910

ELECTRICAL EQUIPMENT

MOTORS - GENERATORS
CONTROL EQUIPMENT

One of America's Largest Stocks

RELIABLY REBUILT
IN OUR OWN SHOP

1 YEAR GUARANTEE

Send us your inquiries

L. J. LAND INC.

148½ GRAND ST., NEW YORK 13, N. Y.
Phone: CAnal 6-6976

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—

• for every industrial and power application
• odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus

Branch Offices:

Houston— Walnut 3-4580
Los Angeles— ANgeles 3-5148

FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL Wire and Cable Co.

2665M N. Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

FLORIDA

MANUFACTURERS AGENTS

Covering ONLY that state, with complete and detailed coverage. Excellent warehousing facilities. We desire to represent one such manufacturer who is looking for capable and honest efforts with definite results. Operating in one state only enables us to give the type of representation you want.

RA-8446, Electrical Construction and Maintenance
330 W. 42nd St., New York 36, N. Y.

TELEPHONE CABLE

NEW, UNDERGROUND, NEOPRENE RUBBER, 17 GAUGE COPPER, DUAL CONDUCTOR, 2500' REELS $25.00. PRICE CONCESSION QUANTITY ORDER. SAMPLE ON REQUEST.

CRAMER & MAURER
2330 S. Rt #7, Holywood, Fla.

ELECTPICAL CONTRACTORS ESTIMATING HANDBOOK

"A Unique Tool of the Trade"

WRITE FOR DESCRIPTIVE FOLDER TO
THE ESTIMATOR PUBLISHING CO.
4102 Wilson Road Kenosha, Wis.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

Technical Sales Representatives: Nationally known organization rated AAA-1, manufacturing reinforced Polyester sheet, plate and shapes, seeks responsible individuals or firm to fit in with national distribution plan. Replies must state background and experience. All replies kept in strict confidence. P-8423, Electrical Construction & Maintenance.

SELLING OPPORTUNITY OFFERED

Salesmen-Representatives — All territories to call on wholesale trade and architects with a complete line of fluorescent, slimline and new plexiglass 2 x 2 and 4 x 4 squares etc. Excellent opportunity for high caliber men to make money. Liberal commission, protected territory. Write giving full information on lines carried and territory covered. Mercury Electric Co. 207 So. 13th Ave. Mt. Vernon, N. Y.

POSITION WANTED

Electrical Supply Firms—Registered Engineer, 38, business inclined, thoroughly experienced all types industrial and commercial control, power, lighting applications. Desires associating with growing concern, either as associate or partner. Confidence respected. PW-8330, Electrical Construction & Maintenance.

If there is anything you want
that other readers can supply
OR . . . something you don't want—
that other readers can use—
Advertise it in the
SEARCHLIGHT SECTION

WHERE TO BUY

Equipment, Materials, Services and Supplies for Electrical Construction—Maintenance—Repairs

Slimline
FLUORESCENT LAMPS!

choose the best

SUPRO LUX

DEPENDABLE, TOP QUALITY,
HIGH LUMEN OUTPUT, LONGER LIFE

write for our special low, quantity prices!

made by
SUPRO LUX
MANUFACTURING CO., INC.
406-416 EAST 161st ST.
BRONX 51, NEW YORK

A WORD TO WISE CONTRACTORS

In selecting time and money saving equipment for 1956, be sure to include that time-proven drilling tool, the Wodack "De-All."® Does many jobs and does them well. Lasts for years because of the A-1 Wodack factory service. Ask for Bulletin 510-EC and learn why it's the most useful drilling and hammering tool for you to buy. Electrical contractors have been using it for 40 years. WODACK ELECTRIC TOOL CORP., 4627 W. Huron St., Chicago 44, Ill., U.S.A. Phone AUstin 7-9866.

ELECTRIC HAMMER

ELECTRIC DRILL

Wodack ® Electric Tools Since 1916

THIS WHERE TO BUY SECTION . . .

is a special classification for manufacturers desiring advertising in space units smaller than the minimum run of book display space. Space is available in this section in units from one to four inches. Every advertisement is indexed. This section can be used economically to promote new product users and uses, establish new sales outlets, reach the buying influences—at an extremely low cost.

ROBOT OPERATORS

OPEN - CLOSE - LOCK DOORS, GATES
. . . Electronically

COMMERCIAL, INDUSTRIAL
RESIDENTIAL & SPECIAL

Write for Catalog
ROBOT APPLIANCES, INC.

Advertising In This Issue

Abolite Lighting Div., Jones Metal Products Co. 169
• Accurate Mfg. Co. ..... Second Cover
• Adam Electric Co., Frank 125
Allen-Bradley Co. 147, 148
Allis-Chalmers Mfg. Co. 89, 112
Alter Co., Inc., The Harry 170
• American Brass Co., The American Metal Hose Branch 131
Anaconda Wire & Cable Co. 48, 49
Appleton Electric Co. 2
• Arro Expansion Bolt Co. 134
• Arrow Conduit & Fittings Corp. 126

• Baldor Electric Co. 129
Barth Corporation, The 167
Beaver Pipe Tools 142
Belden Mfg. Co. 111
Blackhawk Mfg. Co. 28, 29
Briegel Method Tool Co. 35
• Bryant Electric Co., The 36
Buffalo Forge Co. 106
BullDog Electric Products Co. 109, 140
Burndy Engineering Co. 81

• Century Electric Co. 92
• Champion DeArment Tool Co. 82
Circle F Mfg. Co. 120
• Conduit Pipe Products Co. 130
• Continental Wire Corp. 108
Cordomatic Div. of the Vacuum Cleaner Corp. of America 122
Corning Glass Works 151
Crescent Ins. Wire & Cable Co. 38
• Crouse-Hinds Co. 6, 97
Cutler-Hammer, Inc. 54

• Day-Brite Lighting, Inc. 50
duPont deNemours & Co., Inc., E. I. 39, 85

Edwards Co., Inc. 1
Efficiency Elec. & Mfg. Co. 166
Electrical Construction & Maintenance 98, 99
Electrical Fittings Corp. 23
Electromode Corp. 149

• Fullman Mfg. Co. 110

• General Cable Corp. 20, 21
• General Electric Co.
• Apparatus Sales Div. 14, 15, 16, 17, 18, 19
• Construction Materials Div. ..... Fourth Cover
Distribution Assemblies Dept. 86, 87
Insulating Materials & Alkanex, Chemical Materials Dept. 105
Lamp Div. 123
• Globe Co., The 144
• Graybar Electric Co., Inc. 56
• Greenlee Tool Co. 160
• Guth Co., The Edwin F. 43

Hazard Insulated Wire Works 26, 95
Heinemann Electric Co. 53
• Helwig Co. 168
• Hose-McCann Telephone Co., Inc. 132
Hubbard & Co. 33
Hubbell, Inc., Harvey 136
• Huenefeld Co., The 124
Husky Products Inc. 104

• Insul-8-Corp. 145
• I-T-E Circuit Breaker Co.
Small Air Circuit Breaker Div. 34
• Switchgear Div. 156

• Johns-Manville 90, 153
Jones Metal Products Co., The 169

Kalamazoo Tank & Silo Co. 130
Kennecott Copper Corp. 40, 41
• Keystone Mfg. Co. 150
Klein & Sons, Mathias 118

• Leviton Mfg. Co. 139
Litecontrol Corp. 127

Marcus Transformer Co., Inc. 166
• McGill Mfg. Co., Inc. 161
McGraw-Hill Technical Writing Service 170
• Midwest Electric Mfg. Co. 116
Miller Co., The 37
Millers Falls Co. 152
• Minerallac Electric Co. 154

National Electric Products 22

• Okonite Co., The 26, 95
• Oster Mfg. Co., The 30

Page Steel & Wire Division American Chain & Cable 88
Pass & Seymour, Inc. 100
• Phelps Dodge Copper Products Corp. 31
Pierce Renewable Fuses, Inc. 162
PLM Products, Inc. 164
Pyle-National Co., The 51
Pyramid Instrument Corp. 138

Quadrangle Mfg. Co. 158

• Rambusch Decorating Co. 52
• Rawlplug Co., Inc., The 84
RCA Service Co., Inc. 169
Remington Arms Co., Inc. 107
Republic Steel Corp. 12, 13
• Revere Electric Mfg. Co. 170
Reynolds Metals Co. 121
Ridge Tool Co., The 96
Robot Appliances, Inc. 171

Rockbestos Products Corp. 46
• Rodale Mfg. Co., Inc. 159
• Rome Cable Corp. 24, 25
Royal Electric Co., Inc. 165

• S & C Electric Co. 27
• Signal Engineering & Mfg. Co. 168
Simplet Electric Co. 167
• Simplex Wire & Cable Co. 8
Sola Electric Co. 163
Spang-Chalfant (Div. of the National Supply Co.) 101
Square D Co. ..... Third Cover, 133
• Standard Transformer Co. 164
• Steel City Electric Co. 45
Steel & Tubes Division 12, 13
Sticht Co., Inc., Herman H. 154
Supro Lux Mfg. Co., Inc. 171
Sylvania Electric Products Inc. 119

• Thiel Tool & Eng. Co., Inc. 132
• Thomas & Betts Co., Inc., The 42
Tork Clock Co., Inc. 144
• Triangle Conduit & Cable Co., Inc. 143

• United States Rubber Co. 11
Universal Motor Co. 94

Virden Co., John, The 135

• Wagner Electric Corp. 32, 102
Wakefield Co., The 47
Western Insulated Wire Co. 137
Weston Electrical Instrument Corp. 83
Where To Buy 171
• Wiegand Co., Edwin L. 128
Willys Motors, Inc. 155
• Wodack Electric Tool Corp. 171

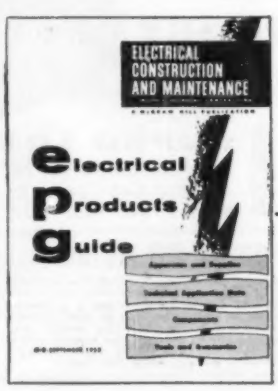
Youngstown Sheet & Tube Co., The .. 44

CLASSIFIED ADVERTISING
F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES ... 171

EDUCATIONAL 171

EQUIPMENT
(Used or Surplus New)
For Sale 171



• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

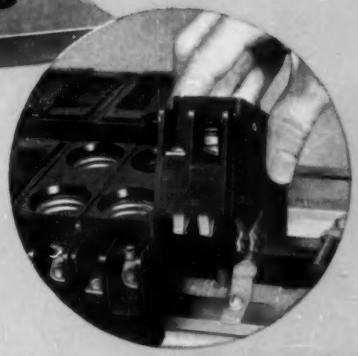
For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

It's a Scoop! FUSIBLE SERVICE EQUIPMENT with *PLUG-IN* FLEXIBILITY!

How well you know it—service entrance requirements have skyrocketed! More circuits needed! A greater variety of circuit combinations needed! This has been the problem—how to get the device with exactly the right combination of circuits, when you need it. Now, Square D gives you the answer—**plug-in fusible circuits**!

Square D offers you two new basic devices, one with space for 28 circuits—the other, 40. Both devices have a 200 ampere main pullout.

Boxes, interiors and fronts, as well as packaged plug-in units (plug fuse or pullout types) are available off-the-shelf from your Square D distributor—right now!



All plug-in units feature Square D's exclusive *SWINGRIP* mounting—easy, speedy installation, automatic alignment and positive contact with bus bars.

Write* for Bulletin SD-36. *Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY